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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

ADDITIONAL SERIES IX.

THE USEFUL PLANTS OF NIGERIA.

PART I.

LONDON:
PRINTED FOR HIS MAJESTY'S STATIONERY OFFICE,
By DARLING & SON, Ltd., 34-40, Bacon Street, E.

And to be purchased, either directly or through any Bookseller, from
WYMAN and SONS, Ltd., Fetter Lane, E.C.: or
OLIVER & BOYD, Tweeddale Court, Edinburgh; or
E. PONSONBY, 116, Grafton Street, Dublin.

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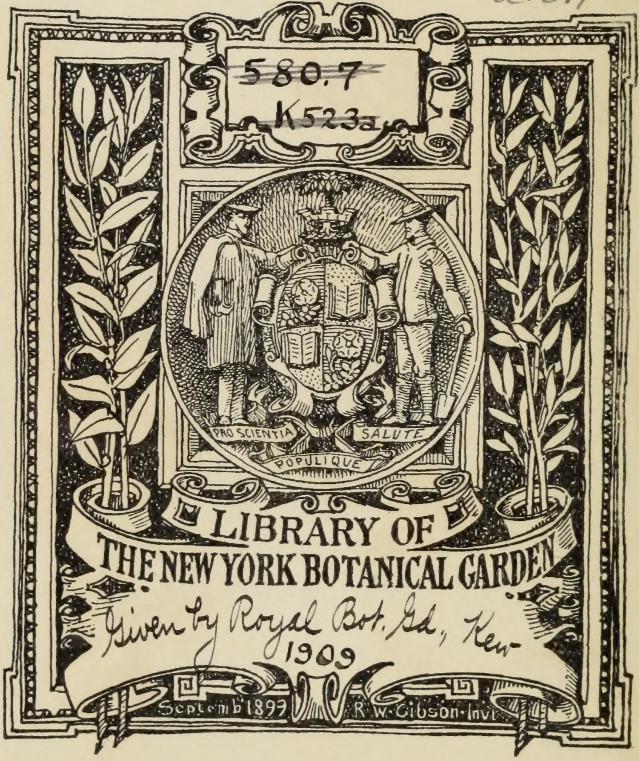

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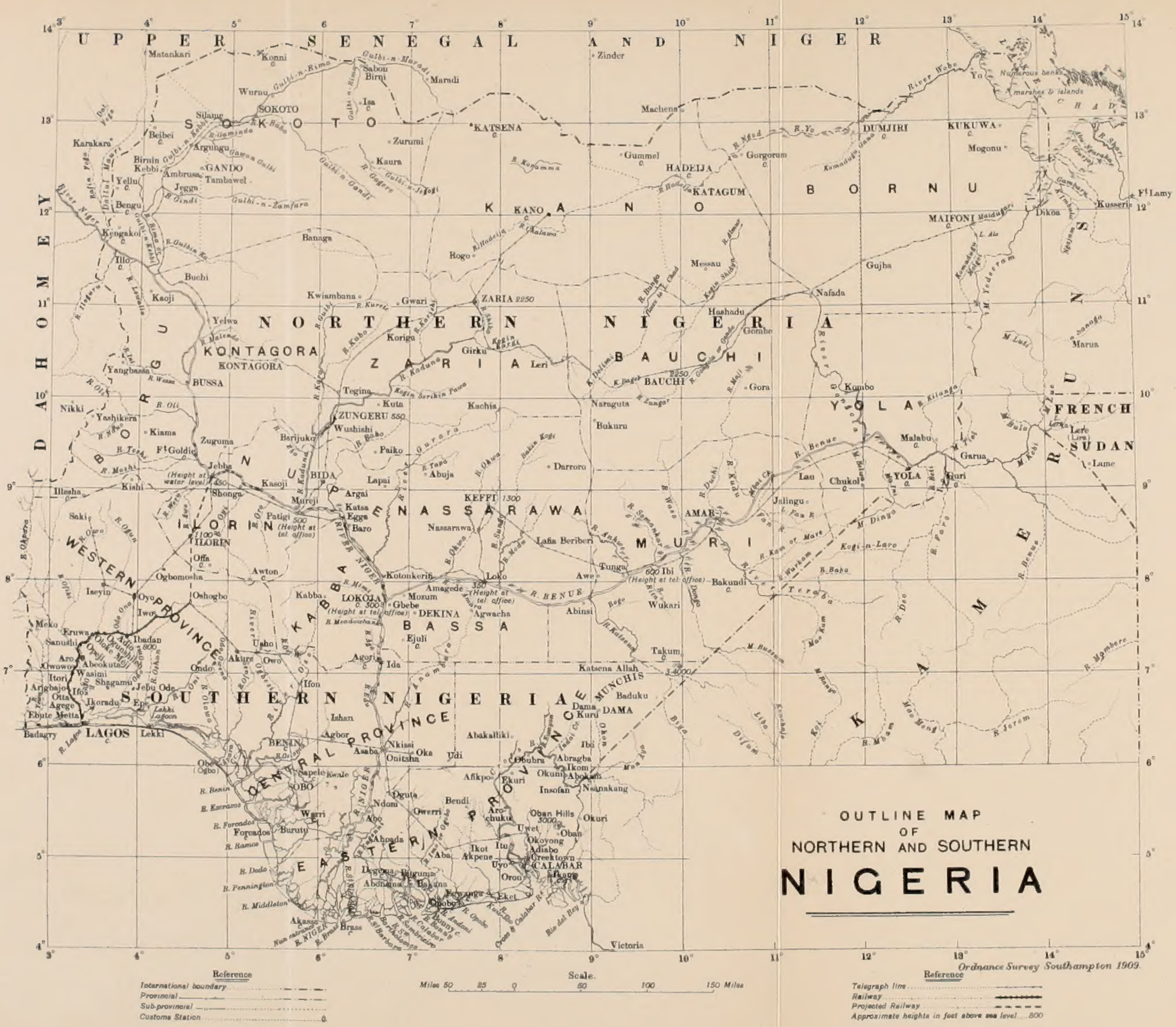
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KANO
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NORTHERN NIGERIA
KONTAGORA
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ILORIN
NASSARAWA
MURI
KABBA
BASSA
MUNCHIS
KAMERUN
FRENCH SUDAN
DAHOMEY
CHAD
WESTERN PROVINCE
SOUTHERN NIGERIA
CENTRAL PROVINCE
EASTERN PROVINCE
LAGOS
CALABAR
ZUNGERU 550
LOKOJA
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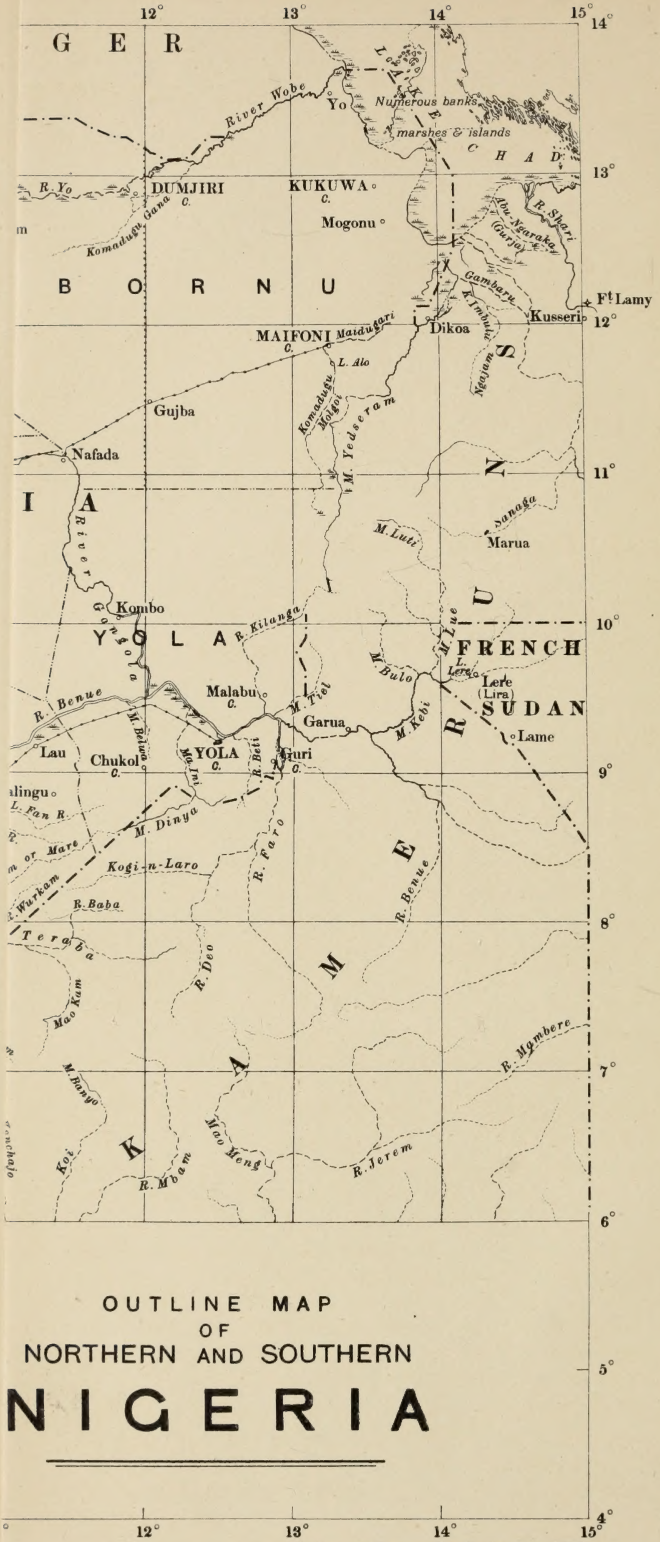
OUTLINE MAP OF NORTHERN AND SOUTHERN

NIGERIA

Ordnance Survey Southampton 1909.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C.
Mogonu
Komadugu Gana
R. Shari
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MAIFONI
C.
Maiduguri
L. Alo
Komadugu Molgoi
M. Yedseram
Ngajam
Gujba
Nafada
I A
River Gongola
M. Luti
Sanaga
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M. Lue
FRENCH
SUDAN
L. Lere
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(Lira)
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Malabu
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Lame
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Ma. Ini
R. Beti
Guri
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Lingu
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M. Dinya
Mare
Kogi-n-Laro
R. Faro
R. Benue
R. Wurkam
R. Baba
Teraba
R. Deo
Mao Kam
R. Mambere
M. Banyo
Koi
Mao Meng
R. Mbam
R. Jerem
K A M E R U N
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OUTLINE MAP
OF
NORTHERN AND SOUTHERN
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Ordnance Survey Southampton 1909.

Reference

Telegraph line
Railway
Projected Railway
Approximate heights in feet above sea level 800

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ADDITIONAL SERIES IX.

THE USEFUL PLANTS OF NIGERIA.

J. H. HOLLAND.

NIGERIA comprises the two colonies of SOUTHERN NIGERIA and NORTHERN NIGERIA. The combined territories lie approximately between the parallels 4° to 14° N. and the meridians 2°.30′ to 14° E. and cover in all an area of 335,000 square miles. The main boundaries are: on the North, the French Sudan; on the South, the Atlantic Ocean; on the East, Lake Chad and the German Cameroons; and on the West, the Colony and Hinterland of French Dahomey.

This area was formerly divided into the Colony of Lagos, the Niger Coast Protectorate (also known as the Oil Rivers Protectorate, 1884–1893), and the territory administered by the Royal Niger Company under a Royal Charter. Lagos was proclaimed a West African Settlement, under the control of the Governor of Sierra Leone, in 1866; it became part of the Gold Coast Colony in 1874, and a separate colony in 1886. In 1906 it was made the Western Province of Southern Nigeria.

The Niger Coast Protectorate was formed in May, 1893, and included the land lying between the Lagos Colony and the Cameroons. The coast line extended from Ogbo at the south-east corner of the Lagos Colony to the Forcados river, and again from the Nun mouth of the Niger, near Akassa to the Rio del Rey; the northern boundary extended from Akure (80 miles or so inland from Ogbo) through Idah on the Niger (about 200 miles from the mouth of the river) to the German boundary. The Protectorate was renamed SOUTHERN NIGERIA on January 1st, 1900.

The territories of the Royal Niger Company included what is now Northern Nigeria and the river Niger with a certain stretch of land on each side, divided approximately by the coast line from Forcados river to the Nun mouth of the Niger. The Charter of the Company was granted on July 10th, 1886, and the territories were governed

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by a Council in London. The area south of Idah was transferred to Southern Nigeria in 1900 simultaneously with the establishment of the Protectorate of Northern Nigeria, which included the country north of this boundary under the control of the Company.

SOUTHERN NIGERIA was constituted January 1st, 1900, and includes the territory of the Royal Niger Company south of Idah, together with the Lagos Colony. The inclusion of Lagos was proclaimed on May 1st, 1906. The headquarters of Southern Nigeria have been transferred from Old Calabar to Lagos. The total area of the territory is about 77,000 square miles.

It is unnecessary to enter into details as to the original administrative divisions of the Colony, it will be sufficient to state the present arrangements.

There are three Provinces :—1. The **Western Province**, which is coincident with the old Lagos Colony ; 2. The **Central** or **Niger Province**, and 3. The **Eastern** or **Old Calabar Province**. Each Province is divided into Districts.

1. The **Western Province** contains the Districts of Ibadan, Oyo, Ilesha, Ondo, Epe, Jebu-Ode, Ikorodu, Badagry, Meko and Oshogbo.

2. The **Central** or **Niger Province** is divided into the Districts of Warri, Sapele, Benin City, Ifon, Forcados, Aboh, Idah, Onitsha, Udi, Asaba, Ishan, Kwale, Agbor, and Oka.

3. The **Eastern Province** contains the Districts of Calabar, Oban, Ikom, Obubra, Abakalliki, Afikpo, Bendi, Aro-Chuku, Ikot-Ekpene, Uyo, Eket, Opobo, Bonny, Aba, Ibi, Owerri, Ahoada, Degema, and Brass.

Each Province is controlled by a Provincial Commissioner and each District is placed under the charge of a District Commissioner.

The Revenues on Exports and Imports are collected by Southern Nigeria for the whole of Nigeria. Northern Nigeria having no sea-board receives annually a stated proportion of the dues from the Southern Colony ; * the amount of which is determined by the Secretary of State.

The principal Customs Stations are Lagos, in the Western Province ; Forcados, Warri, Sapele, Benin, (Koko Town) in the Central Province ; Calabar, Abokam, Ikang, Opobo, Egwanga, Bonny, Bakana, Degema, Buguma, Brass and Akassa in the Eastern Province.

PHYSICAL FEATURES.

The configuration of SOUTHERN NIGERIA is in detail subject to some uncertainty. Until the whole area has been fully explored and properly mapped accurate information can only be given as to the parts actually visited. All the maps constructed so far have been compiled in England from sketches made at various times by numerous surveyors independently of each other. A systematic survey of the whole Colony is now in progress by the Department of Surveys.

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* This contribution was £57,500 in 1904 ; £78,750 in 1905 ; £75,000 in 1906.

The most marked feature of the country is the low-lying belt of land along the coast line, which consists of swamps with rank vegetation made up almost entirely of mangroves on the outer fringe; behind this there is a belt of mixed vegetation growing on the ground which has been built up to a large extent by the mangroves in the course of ages. On the somewhat higher ground extensive forests of mixed trees are found interset with farms, open grass lands (not pastures), and jungle bush, which consists generally of neglected or spent farm lands. The mangrove swamps may extend 50 to 100 miles inland, along the banks of all the rivers, as far as the tidal influence is felt.

The geological features of the country have been described by Parkinson.* There appears to be a mass of crystalline rocks forming a rude semi-ellipse indented on the east by the complex of the Oban hills and crossing the Niger in Lat. 7° 19′ N. The cretaceous rocks which have been found in the Cameroon have been traced westwards round the base of the Oban hills up the Cross river to Abakalliki, and probably extend further northward and westward. To the westward from Asaba to Benin City and Ifon and through the Ijebu country to Abeokuta, the country is an undulating plain consisting entirely of rocks later than cretaceous in age.

There are four well marked types of country. The first is that built up of complexes of crystalline rock, the second that formed by the cretaceous strata, the third composed of tertiary beds, the most conspicuous of which are the red sandy clays typical of Ijebu and Benin, and the fourth, which is still in process of formation, is the type of the delta and mangrove swamp. Each of these four types exhibits physical features peculiar to itself and not shared by any other member of the series.

The salient characteristics are briefly as follows. The Oban hills belonging to type (1) form an unorientated group of peaks attaining an elevation of rather over 3,000 ft., and are characterized by steep slopes, drained by a rejuvenated river system. The best example of the second type of scenery is that between Afikpo and Abakalliki, where the effects of erosion on a group of strata of varying hardness folded by a north and south movement are admirably seen. It is an open country of the orchard type, most assiduously cultivated, but on the northern and southern slopes of the Oban hills the cretaceous rocks are covered with dense bush which masks the physical features. The country formed by the softer red tertiary loams and sands, characteristic of parts of the central and western provinces, is exceedingly monotonous; it is covered with heavy bush and drained by a very mature river system. The water courses, however, are greatly encumbered by sand banks. Near Asaba low hills occur, but for the most part, *e.g.*, between Ifon and Sapele, the surface of the country is gently undulating.

With regard to the delta region, it is probably in reality not so flat as it appears from the sea, for not uncommonly inliers of the red sands of Benin form low hills which are surrounded by mangrove swamps.

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* Report, British Association, 1906, p. 622.

There appears to be no elevation that could be fitly described as a mountain, although in certain parts the land rises to a height of 3,000 ft. or so above sea level.

RIVERS AND WATERWAYS.

The water courses are very numerous. In the western province there are no oceanic rivers of any importance, but near the coast there is an extensive system of lagoons and creeks, fed by the rivers Ogun, Odo-Ona, Oshun, Oni, and several smaller streams.

The most extensive lagoons are the Lagos and Lekki. The latter, which is about 30 miles long by 15 miles broad in its widest part, is a beautiful sheet of water dotted with forest-covered islands. The only opening for steamers of shallow draft is at Lagos, although small craft can sail through these lagoons from the western limit of the province to the Benin river, a distance of more than 200 miles. Passengers for Lagos are transferred from the ocean-going steamers to branch boats in Lagos roads, and cargo is transhipped in Forcados river.

To the eastward, the coast line of the central and eastern provinces is one long series of river mouths. These rivers are navigable by ocean-going steamers for certain distances, and all of them are more or less connected with each other by an extensive system of creeks which can be navigated by means of launches or canoes as far, at least, as the Opobo river.

The Benin river is the first of the series. Steamers drawing more than 10 or 12 ft. of water cannot enter by the mouth, but large steamers can proceed to Sapele through the creek from the Forcados river. The river Escravos has a shallow bar. The Forcados river is navigable along the Warri branch to Warri (a distance of about 50 miles) for large steamers, and for smaller craft through the Warri creek to the Niger of which river it forms one of the principal outlets. The rivers Ramos, Dodo, Penington and Middleton all have bars which do not admit the passage of vessels drawing more than 8–10 ft. of water. The Nun is the principal outlet of the Niger, which is the largest river in the Colony. The Niger is navigable in the rainy season for large steamers as far as Jebba (a distance of about 450 miles), but in the dry season only as far as Lokoja (about 250 miles) though vessels of shallow draft can go about as far as Mureji near the Kaduna river and from there onwards navigation is only possible by canoe. The Brass river has a shallow bar, but some ocean vessels can cross with safety. The St. Nicholas, St. Barbara, St. Bartholomew and Sombreiro all have bars too shallow to allow the passage of ocean steamers. The Bonny river is navigable only for a short distance from the sea (the town of Bonny is 8 miles from the mouth). The Andoni has a shallow bar, and the Opobo a shallow but navigable bar. The Kwa-obo entrance, suitable for small steamers only, and the Calabar estuary into which the Cross river the Akwayafe and Qwa rivers flow before reaching the sea, complete the series. The Cross river is sometimes regarded as the principal outlet and the other rivers as tributaries; this would appear to be the more correct view, as the Cross river is by far the largest of the group. Large steamers can get conveniently to Old Calabar town, about 45 miles from the sea and for 10 or 20 miles beyond. The Cross river is navigable nearly to the German boundary in the wet season by launch, and in the dry season only as far as Itu (a distance of about 50 miles from the junction with the Old Calabar river). In the dry season it is possible to travel the whole distance by canoe, but in places, owing to the numerous sand banks in the bed of the river, it is a matter of much difficulty.

The Engenni river is an inland stream which takes its rise in the Oguta lake, about 110 miles to the north from the sea coast, and meets the Sombreiro near Degema, about 30 miles from the sea. An idea of the strength of the current may be gained from the fact that it takes 3 days to ascend by canoe as far as Idu, 80 miles or so from Degema, paddling hard against the stream; whilst paddling hard with the stream it is possible to descend the same distance in one day.

NORTHERN NIGERIA was constituted January 1st, 1900, being proclaimed at the same time as the Southern Colony, and was made to include the country north of Idah on the Niger. The total area of the territory is about 258,000 sq. miles.

It is divided for Administrative purposes into 14 Provinces, viz.:—**Sokoto, Kano, Bornu, Borgu, Kontagora, Zaria, Bauchi, Yola, Nupe, Nassarawa, Muri, Ilorin, Kabba** and **Bassa.**

An outline of the History and Progress of each Province is given in the High Commissioner's Report for 1904,* and from this and other sources, the following brief particulars are quoted. **Sokoto** has an approximate area of 35,000 sq. miles. Horse-breeding and cattle raising form the chief sources of wealth, and it is estimated that there are some 100,000 head of cattle and 40,000 sheep in the province. Ostrich farming is carried on in the north. Except in areas where lack of water precludes cultivation, there is extensive agriculture including rice and cotton. Special crops are grown in the river valleys by irrigation. Weaving, dyeing, and tanning are the principal native industries.

The province of **Kano** comprises an area of about 31,000 square miles and includes the emirates of Kano, Katsena and Daura, which are among the most ancient of the Hausa States.

The industries which have made Kano famous throughout and beyond the Sudan have remained unchanged, and the weaving and embroidery of cloths, the tanning of goat skins, and ornamental leather work, with other minor trades form to-day its staple industries, as they did centuries ago. Its large market is the commercial centre of the Western Sudan, the destination and the starting point of the caravans which traverse the country in all directions. The imports of local origin are chiefly: 1. Salt from the north and east (Asben and Manga); 2. Natron from Damageram and the east; 3. Cattle and horses from Sokoto and Bornu; 4. Kolas from Ganja and Lagos; and 5. Antimony from the Benue. Imports of European origin are: 1. From Tripoli. English cloth, magenta-coloured thread, beads, sugar, scent, mirrors, needles, spices, pepper, burnooses, horse-trappings, and writing paper ; 2. From the south, English cloth, salt, German dyes and Austrian beads. Exports to Europe are leather, ivory, and feathers, the bulk of which go to Tripoli.

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* Col. Rep., Ann. No. 476, 1905.

For a radius of 30 miles round the city of Kano, the country is closely cultivated and densely populated. There are many streams but water is obtained chiefly from wells 15 to 40 ft. deep. The drainage is to the Wobe river, which flows into Lake Chad. All the African grain crops are grown, "dawa" (*Andropogon Sorghum*, Brot., var. *vulgaris*, Hack.) and "gero" *Pennisetum typhoideum*, Rich.) being the staples, the latter especially in the north. Irrigation is practised along the river banks, and crops of wheat, onions, tobacco, sugar-cane, cassava, and other valuable products are raised.

Sir William Wallace* gives an interesting account of the iron smelting industry at Fawa, one of the chief towns in the province.

The province of **Bornu** has an area of about 33,000 square miles. It is mainly a vast plain, stoneless, except for rare outcrops of ironstone, and consists of porous fissured black earth, known as "cotton soil" in India, alternating with or more probably overlaid by sand and broken only by sand dunes. Water is apparently found everywhere at a depth of 54 ft. corresponding to the level of Lake Chad. On the northern boundary of the province is a remarkable Salt desert† described by Lt.-Col. Elliot, R.E., as follows: "The meridian that ascends northward from the parallel of 13° 20′ N. to 14° N. passes roughly through the middle of it. It is covered with grass about 4 ft. high, diversified here and there by lines of Borassus palms, which mark the course of the depressions where water is usually to be found at a small depth below the surface, even if they do not contain pools. Deposits, sometimes of potash, sometimes of what the African is pleased to call table salt, are left wherever the water dries. These deposits are worked by the natives who come from long distances at the end of the rains and establish themselves at the workings in temporary shelters made of palm leaves or grass. They scrape up the soil newly impregnated by the evaporated and infiltrated water, carry it off and fill it into strong baskets, placed in a frame above an earthen pot, water is poured over to dissolve out the salt, and when the receiver below is full of brine it is taken away and evaporated by boiling. The salt thus obtained is not pleasant to European taste nor is it advisable to indulge freely in it. It is neatly packed in mats made of palm leaves and carried long distances to trade."‡

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* Geog. Journ., Vol. viii., 1896, p. 214 ; "Notes on a journey through the Sokoto Empire and Borgu" in 1894.

† This region is called by Capt. Cochrane, the Salt Lake Area, where the natives come in the cool season (October to March) to make salt. He found numerous lakes occupying depressions of the ground surrounded by a few palm trees (Geog. Journ., Vol. xxiii., 1904, p. 127). In a report on some samples of salt from the Bornu Province, examined at the Imperial Institute, it is stated that the area in which the salt is produced appears to extend over about 500 square miles, and to be due west of Kuka, and about 70 miles from the shores of Lake Chad, part of the area lying in French territory (Col. Rep., Misc., No. 46, 1908, p. 2).

‡ Geog. Journ., Vol. xxiv., 1904, p. 517, "The Anglo-French Niger-Chad Boundary Commission."

Borgu province has an area of 12,000 square miles. In South Borgu the people are agricultural, but are not industrious, and show no desire to acquire wealth or to trade. In the North the settlements of Fulani from Gando rear cattle, while the Baribas are agricultural. The industries are confined to the simple wants of the people, and there is little trade. The soil appears to be rich black loam singularly free from the white ant pest.

Kontagora province has an area of 14,500 square miles.

In the province of **Zaria**, with an area of 22,000 square miles, the chief crop appears to be cotton, which is exported to Kano. The altitude of Zaria station is 2,250 ft., and its climate is consequently one of the most healthy in Nigeria; during part of the year it may be even called bracing and delightful. The great disadvantage is that tsetse fly has been found to exist.

The province of **Bauchi** has an area of 23,200 square miles. The city of Bauchi was once a great centre of the slave trade, and owed such prosperity as it possessed to this fact. The inhabitants are, generally speaking, wonderfully good and industrious agriculturists, rich in flocks and herds, but are lawless and independent. There are tin mines in the neighbourhood of Naraguta, to which a route was opened up during 1905-06; starting from Loko on the Benue, 110 miles from Lokoja, it traverses the Nassarawa Province, first northwards to Keffi, thence north east to Darroro, and over the Assab, Sura, or Kibyen Plateau. This Plateau is described as "extensive and well watered, with a surprisingly fertile soil," having a general elevation of at least 3,800 feet, and peopled by agricultural Pagans. "These Pagans, though at present mostly cannibals, are manly, straightforward, and industrious. It is probable that this district may have a great future as a local sanatorium, not only for Northern Nigeria, but also for the Coast Administrations."*

Yola province has an area of 16,000 square miles.

The province of **Nupe** has an area of 6,400 square miles. Bida, one of its chief towns, is most advantageously situated as to means of transport. The Niger flows immediately to the south and other navigable rivers, the Kaduna on the west and the Bako on the east, are in its immediate vicinity.

Nassarawa province, with an area of 18,000 square miles, is concerned with iron smelting as its principal industry and salt also is obtained in the Kiana district.

The province of **Muri** has an area of 25,800 square miles. The three main trade routes of the country converge at Wase, viz., from the salt district at Awe, from the kola-growing centres of Kentu and Bafum in the Cameroons, and from Gashaka, *viâ* Amar, for cattle. The climate here is good but the actual valley of the Benue, which runs through the centre of the province, is infested with mosquitos and tsetse fly.

The salt from the brine springs at Awe and elsewhere has been analysed at the Imperial Institute, and it appears probable that a nearly pure salt could be prepared without difficulty. The output in 1904 was estimated at 277 tons per annum, obtained during the dry season only.*

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* Col. Rep., Ann., No. 516, 1907, p. 41.

Ilorin, with an area of 6,300 square miles, is a province rich in agricultural and sylvan products. Among the former, in addition to the usual crops, are tobacco, cotton, rice, pepper, ground nuts, and kolas; the latter include great quantities of shea (*Butyrospermun Parkii*, Kotschy), as well as of palm oil and rubber. The people are good agriculturists. The city of Ilorin is, next to Kano, probably the largest trade centre in the country.

The province of **Kabba,** with an area of 7,800 square miles, consists of healthy uplands and fertile valleys. The industries are merely such as supply the wants of a primitive people. It is in this province that Lokoja, once the headquarters of Nigeria, is situated. Kola nuts, English cotton goods, and native cloth, natron and live stock, are the chief objects of trade. The native products are palm oil, shea, rubber, and cotton.

Bassa has an area of 7,000 square miles. This province is probably richer in natural products than any other in the Protectorate.

PHYSICAL FEATURES.

The general altitude of NORTHERN NIGERIA is not great, but in the neighbourhood of Bauchi an elevation of 3,000 feet and upwards is attained. To the south of this province is the Murchison range, whose southern slopes are drained by the Benue.

Some idea of the character of the country may be gained from the altitudes of the following places:—

Loko, on the Benue about 400 miles from the sea is about 425 feet above sea level, thence almost due north to Kano the following approximate altitudes have been observed.† Keffi about the centre of Nassarawa province, 100 miles distant from Loko; 1,000 feet. Katill in Zaria province, 100 miles north of Keffi, is 2,530 feet above sea level, and is said to be one of the highest districts in the whole of the Hausa States; the town of Zaria 50 miles further north is 2,250 feet, and Kano, about 80 miles distant, 1,690 feet. Sir Frederick Lugard‡ has described Zaria as being situated on a plateau which falls away on all sides except towards the east where it rises into highlands of which Bauchi is the centre, the latter place being surrounded by mountains of much greater altitude. He gives the altitude of Yola (200 miles or so south-east of Bauchi) as about 800 or 900 feet; Lokoja on the Niger nearly 300 miles south-west of Bauchi, as not more than 300 feet above the sea; Jebba, about 250 miles south-west of the Zaria plateau, 500 feet, and Illo on the French frontier, some 250 miles east of the Zaria plateau as about 1,000 feet. The same author* describes the "two Hydrographic Systems" of Northern Nigeria, that of the Niger and that of which Lake Chad is the centre, the watershed being more or less along the line from Kano to Katsena, and along the northern slopes of the Bauchi hills.

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* An account of this manufacture is given in Col. Rep., Misc., No. 46. 1908, pp. 10–14, and on p. 24 the product is stated to be "of good quality and suitable for culinary purposes." According to the analysis it compares favourably with much of the salt used in Europe.

† *See* Geog. Journ., Vol. viii., 1896, p. 202, "The Hausa Territories," by Rev. C. H. Robinson.

‡ Geog. Journ., Vol. xxiii., 1904, p. 13, N. Nigeria.

THE PRINCIPAL RIVERS.

The Niger in its lower course, from the western boundary near Illo to Southern Nigeria, is the principal river. On the north the chief tributaries are the Gulbin draining the province of Sokoto, the Kaduna on which Zungeru is situated (navigable for about 75 miles as far as Wushishi) draining the provinces of Zaria and Nupe, and the Guarara, along the north and west of the province of Nassarawa which "offers no facilities for navigation."† On the south there are the Wessa, Oli, and Teshi in Borgu.

The river Benue, which flows in from the German boundary near Garua and Yola, unites with the Niger near Lokoja; its chief tributaries are on the north the Gongola in Yola, navigable by steam launch as far as Nafada (Bauchi), the Ankwe in Muri, and the Modu in Nassarawa. On the south the Teraba is said to be 200 yards across at its widest part; it is navigable in the wet season by powerful light draught launches, but in the dry season only by canoe.‡ There are also the Donga and Katsena in the province of Muri.

The rivers draining the basin of Lake Chad may be best described in connection with the lake. An account of the drainage system of this region was published recently in the N. Nigeria Gazette,§ and is as follows:—

"The lagoons, which lie in the depression known under the name of Lake Chad, receive their water from various rivers, from the West, South-West and South.

"No water comes from the sandy desert to the North and North-East; and to the South-East some uneven country prevents the Batta from reaching Chad with the waters from Wadai.

"The Bahar-el-Gazal to the East, with its continuation to the Bodele and Egei country, lies lower than the level of the Chad and may therefore be regarded as the outlet of the Chad lagoons, probably once the open continuation of the rivers flowing into Chad. To the East, we have at present no proof of its connection with Chad, except the great amount of water, found everywhere in the valley, at a very low depth, which can come from nowhere but the lagoons to the West.

"The two chief tributaries of Chad are the Kommadugu of Yo, or 'River Wobe,' to give its official title in Northern Nigeria, and the Shari.

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* Geog. Journ., Vol. xxiii., 1904, p. 13, N. Nigeria.

† Geog. Journ., Vol. xxiii., 1904, p. 10, N. Nigeria.

‡ Geog. Journ., Vol. xiv., 1899, p. 631, "Regions of the Benue," L. H. Moseley.

§ N. Nigeria Gaz., Vol. iii., No. 6, 1907, pp. 57–58, Report on Lake Chad, by Mr. Hans Vischer.

" The first originates in the Eastern Hausa states, and, traversing about 300 miles, from West to East, flows into Chad near Yo, on the West shore. It receives no water from Bornu proper, and is a flowing stream for the greater part of the year, carrying most water at the end of December.

" The Shari is the greatest river of the Chad system. Not far from its mouth it unites with the Logone, and for a great distance is a navigable stream, carrying actually a small flotilla of French steamers. It flows into Chad on its Southern corner, divided into several arms.

" For some distance the Shari marks the frontier between the French and German territories.

" Between Shari and Kommadugu of Yo, there is the Yedseram. It collects its waters from the Western slope of the Mandara Hills and from the Marghi country, flows due North for a considerable distance, when it turns East and vanishes into a swamp near Dikoa.

" The rivers near Ullgo and Wobbio, as well as the channel near Missene, appear to be the continuation of the Yedseram, but these water-channels only have a riverlike appearance for a short way, ending, as they begin, in a swamp.

" The Alo lagoon near Konduga, British Bornu, to a great extent receives its waters from the Yedseram.

" The Maiduguri river is in connection with this lagoon. Former travellers called it the Ngadda. It flows for some months in the year from South to North to disappear in the swamps near Chad, a little West of the Yedseram."

Lake Chad is the only known lake of importance in Nigeria, but it is regarded more as " a permanent inundation than a lake in the true sense of the term," and has no outlet to the sea. It is about 1,150 ft. above sea-level, and only 20 ft. deep in the deepest parts, with an area, in the dry season, of 10,000 square miles and of 50,000 square miles in the wet season. The ancients called this water Libya Palus, and judging from this name they also must have regarded it as more of a swamp than a lake. This was in the days when Africa was thought to be a province bordering on the Mediterranean Sea and Libya was the name for the then known portion of the continent.

The administrative divisions, and the topography of the separate Colonies having been briefly described, a few particulars as to the CLIMATE, PEOPLES, MEANS OF COMMUNICATION, TRANSPORT and CURRENCY, for the whole Protectorate now follow.

CLIMATE.

The whole area of NIGERIA falls within the tropics, and having said this it will only be necessary to give a few figures illustrative of the general climate. These have been taken from records made by careful observers in various parts, and the following details are taken from the Official Reports.

Temperature.—" The mean temperature for the year 1906 at Lagos Observatory was 80·3°. The highest shade temperature 99°

was recorded at Onitsha (Central province), and Afikpo (Eastern province) in March, at Asaba (Central province) in February, and Benin City (Central province) in March, and the lowest 54·5° at Benin City in January."*

"The mean temperature of Old Calabar (Eastern province) in 1905 was 81·21°, and the mean daily range 15·4°. The highest and lowest shade temperatures were recorded at Bonny (Eastern province) in February, being 96·21° and 62·13° respectively."†

The Principal Medical Officer reports that "the highest temperature recorded in Northern Nigeria during the year 1905 was 118° at Maifoni (Bornu), on April 8th, and the lowest 39° at Kano, on February 2nd, the highest mean temperature for the year being at Kontagora, 82°, and the lowest at Zaria, 74°. The mean temperature in 1905 at Zungeru (headquarters) was 80°.‡ The temperature in Bornu although reaching 106° in the shade during the hot season is liable to fall at times (in December and January) so low as to cause occasional frosts, more particularly in the region of Lake Chad. In western Bauchi (Bukuru) "the temperature in the dry season is stated rarely to exceed 85°, and in November and December it falls below freezing point."§

Rainfall.—In SOUTHERN NIGERIA, during 1906, "the maximum rainfall was 251·49 ins. at Egwanga (Eastern province), and the minimum 40·92 ins. at Oloke Meji (Western province). The rainfall at Lagos was 74·76 ins., at Calabar 156·64 ins., and at Bonny 142·26 ins."‖ These places, with the exception of Oloke Meji are all on or near the coast, where the heaviest rainfall usually occurs.

In NORTHERN NIGERIA in the year 1905–06, "the greatest rainfall was at Zaria with 51·27 ins., and the lowest, Sokoto, with 33·32 ins., the maximum fall on one day being at Ilorin on June 2nd., 4·04 ins."‡ In Bornu the rainfall, which is generally regarded as being uncertain and small (May to October), was considered exceptionally good during the same year, 25 ins. being registered at Maifoni.¶

There are two well marked seasons, the wet and the dry. The wet season may be regarded as from March to October and the dry season as through the remainder of the year, although tornados, more particularly between the seasons, are of frequent occurrence.

The Harmattan, a wind which more or less affects the whole of the coast of Guinea is prevalent during the dry season. Its usual course is from the north-east, across the Sahara desert, with varying degrees of force; sometimes it blows with great violence, whilst at others it is not more than a gentle breeze. This wind is characterized, moreover, by excessive dryness, and by a thick haze attributable in a large measure to the fine particles of sand which it draws with it. The nights at these times are cold and often somewhat trying, even though the temperature may not fall below 65°.

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* Col. Rep., Ann., No. 554, 1908, for 1906, S. Nigeria, p. 54.

† Col. Rep., Ann., No. 512, 1906, S. Nigeria, p. 36.

‡ Col. Rep., Ann., No. 516, 1907, N. Nigeria, p. 105.

§ Col. Rep., Ann., No. 516, 1907, N. Nigeria, p. 42.

‖ Col. Rep., Ann., No. 554, 1908, for 1906, S. Nigeria, p. 55.

¶ l.c., p. 32.

PEOPLES.

The native inhabitants of NIGERIA are in general typical negroes. but the tribal and intertribal divisions are so numerous that to give a full and satisfactory description would be a task of exceptional difficulty. Several important works * on the people of this region have been published in recent years, and most writers on the country have given some information about the natives with whom they have come in contact, but these scattered references require to be properly collated and a comprehensive survey to be made of the nation as a whole.

The superior races appear to occupy the interior of the country, and as one passes inland from the delta of the Niger they gradually improve. Some of the more prominent tribes in SOUTHERN NIGERIA are the Yorubas, extending to Ilorin in the Western province ; the Jekris and Sobos in the Central province ; and the Ibos, Eifiks, Kwas and Akuna-Kunas in the Eastern province. They are Pagans for the most part, but some few, especially amongst the Eifiks, have embraced the Christian religion.

In NORTHERN NIGERIA, Hausa is the predominating native race, more particularly in the northern states, and the Fulani the predominating invading, and ruling race ; both of these races are Mahommedans. Other prominent tribes are the Nupes and Yorubas (of Ilorin), also more or less followers of Mahomet. In addition there are numerous Pagan tribes.

The Hausas and Yorubas are in general industrious, and are traders and soldiers ; the native regiments are largely if not entirely recruited from these two races.

Language.—Only a few of the languages have been reduced to writing and of these the Hausa language is the most important as it is the commercial language of the country. The Rev. C. H. Robinson, lately lecturer in Hausa at Cambridge University states,† that " it is possibly, the most spoken language on the Continent of Africa. Its only rivals in numbers are Swahili and Arabic. It has been reduced to writing for at least a century and possibly much longer, and according to history now existing in writing, Kano has been occupied as a Hausa town for about 950 years." He further states that four languages and four only will dominate the whole of the continent of Africa :—" Arabic in the north ; English in the south ; Swahili in Eastern Tropical ; and Hausa in Western Tropical Africa."

Eifik in the Eastern province, or more particularly in Old Calabar was reduced to writing by the earlier missionaries of the United Presbyterian Mission at Old Calabar some fifty years ago.

These two languages, and in addition, Ibo, Uziado, Yoruba and Jekri, have now been made the subjects of written and colloquial examination in the Colony.

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* *See* Appendix I.

† Geog. Journ., Vol. viii., 1896, pp. 208, 209.

Education.—Elementary, Secondary, and Technical Education is now being provided for in the schools established by the Government (Bonny, Benin, Warri, Sapele, Cross river, &c.); the Church Missionary Society (Lagos, Brass, Bonny, Degma, Opobo and Bida), and the United Free Church of Scotland (Calabar and Cross river). The Hope Waddell Institute of this latter Mission, erected at Old Calabar by the Government at a cost of £12,000, is one of the largest secondary schools in the Colony. The Wesleyan Mission (Lagos, Ibadan), and the Roman Catholic Missions (Lagos, Onitsha, and Calabar), have also established schools.

Slavery, once the curse of the country, has been proclaimed illegal in both Colonies.

Population.—The native population of SOUTHERN NIGERIA in 1906 was estimated as follows* :—

Western province	3,000,000
Eastern "	1,500,000
Central "	1,585,000
Total	6,085,000

The Europeans in the three provinces numbered 1,022.

The approximate returns for NORTHERN NIGERIA for the same year were† :—

Province.	Males.	Females.	Total.
Kabba	55,727	62,849	118,576
Ilorin	72,318	107,660	179,978
Muri	214,932	285,869	500,801
Bassa	253,075	272,075	525,150
Yola...	86,188	98,812	185,000
Kano	1,357,000	1,357,000	2,714,000
Sokoto	268,563	292,735	561,298
Zaria	98,000	132,000	230,000
Kontagora	40,807	39,375	80,182
Nupe	61,783	61,783	123,566
Bauchi	460,000	460,000	920,000
Nassarawa	279,285	321,720	601,005
Borgu	11,158	10,715	21,873
Bornu	163,424	239,898	403,322
Grand Total ...	3,422,260	3,742,491	7,164,751

These totals give an average of 79 persons per square mile for SOUTHERN, and 27 per square mile for NORTHERN NIGERIA.

Transport.—Three of the greatest drawbacks to the development of Nigeria in the past have been difficulties of transport, slavery and the varying currency; the one in many instances depending on the other. Formerly the inland carrying was done by natives who carried a load of 60 lbs. or so on their heads. This method is still indispensable in certain districts not yet under effective control, more particularly in those parts of

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* Col. Rep., Ann., No. 554, 1908, p. 56.

† Col. Rep., Ann., No. 551, 1907, p. 99.

Southern Nigeria, where there are no beasts of burden and where wheeled traffic is not possible. The same method is also current in Northern Nigeria, but in certain provinces mules, bullocks, horses and asses are used for the purpose. "It is reported that the introduction of animal transport is gradually taking the place of carriers, but until suitably bridged and metalled roads are constructed, it will be an impossibility wholly to substitute animal transport during the rains."*

In the dry season both cart and pack transport are in use throughout the road from Zungeru to Kano, and in the Bornu province. The tsetse fly in several provinces—Zaria, Yola, &c., causes much loss amongst these animals. Carts have been introduced, but it is said that the climate is detrimental, as the following report seems to indicate. "Out of 100 carts made in England, 80 had, after 18 months' service in Northern Nigeria, to be practically rebuilt, and of the balance 12 were condemned as unfit for further use."†

"Pack transport has been worked with good results in the Sokoto and Kano provinces, while pack camels have taken the place of pack bullocks at Zaria and Kano with excellent results." ‡

Transport near the coast with such magnificent waterways is, as can be readily understood, comparatively easy, and the Marine Department controls an extensive fleet of steam and motor vessels and other craft adapted to the regular mail, passenger, and transport services which have been organized. The first railway in the country was opened to the public in March, 1901, between Iddo island at Lagos and Ibadan, this has since been extended to Abeokuta and Oshogbo, 186 miles in all, the intermediate stations being fixed at Ebute-Metta, Agege, Otta, Ifo, Arigbajo, Itori, Wasimi, Owowo, Aro, Abeokuta, Sanushi, Opeji, Eruwa road, Oloke Meji, Ogunshileh, Ilugun, Adio, Ibadan, Oyo road, Olodo, Lalupon, Iwo, Origo and Ede. This line is now being extended to Northern Nigeria by way of Ilorin and Jebba, on the Niger. A light railway has been constructed from the Kaduna river (at Barijuko) to Zungeru.

This brief note on the transport may be fittingly concluded with a reference to the ancient caravan routes, between Tripoli and Kano—still the most important market centre in Nigeria—across the Sahara desert, by way of Ghat, Asben and Zinder, or by way of Murzuk, Bilma and Lake Chad, a distance of about 1,800 miles; the first mentioned route is the one more usually followed. It is not unlikely that much of the trade will be diverted from this route as the conditions of transport improve southwards to the sea. Dr. Cargill has reported that "the journey from Tripoli to Ghat takes 40 days, and costs from £2 to £3 per camel load. At this point there is always a delay of some weeks to procure fresh camels; and from thence it is a journey of six or seven weeks to Kano, costing £4 to £6. The French levy $2 for each load of skins, and $4 per load of ivory or feathers at Zinder. Roughly, therefore, it may be said that goods take nearly five months at a cost of about £40 per ton by the desert route." * An Arab trader from Tripoli was induced in 1905 to try the route from Kano viâ the caravan road to Zungeru, and thence by the Lagos railway and steamer to Algeria. He was afforded every facility and was well satisfied with the security and advantages of this route. The journey occupied only two months, against the five and sometimes seven months taken over the journey through the desert.

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* Col. Rep., Ann., No. 551, 1907, p. 56, N. Nigeria.

† Col. Rep., Ann., No. 551, 1907, p. 57.

‡ l. c. p. 56.

Postal Service.—An efficient postal system is established between most of the places under European control, and telegraphic communication has been effected, connecting some of the most distant outposts in both Colonies, with offices at the following places :—

In SOUTHERN NIGERIA, Akure, Ibadan, Ilesha, Iseyin, Lagos, Leckie, Ogbomosho, Oshogbo, Oyo, Saki, in the Western province, and at all the railway stations previously mentioned.

Agbor, Asaba, Benin City, Burutu, Fishtown (Benin River), Forcados, Ifon, Oka, Onitsha, Owo, Sapele, Warri, in the Central province. Aba, Bonny, Calabar, Eket, Ikot-Ekpene, Itu, Opobo, Oguta, Owerri, Uwet and Uyo, in the Eastern province.

In NORTHERN NIGERIA, Amar (Muri province), Barrijuko (Zaria), Bauchi, Baro, Bida (Nupe), Egga (Kabba), Ibi (Muri), Ilorin, Jebba (Nupe), Jegga (Sokoto), Kano, Keffi (Nassarawa), Kontagora, Kuta, Lau (Muri), Lokoja (Kabba), Loko (Nassarawa), Maiduguri (Bornu), Nafada (Bauchi), Patiji (Ilorin), Sokoto, Yelwa (Kontagora), Yola, Zaria and Zungeru (Zaria).

This progress in the telegraphic system has been accomplished since about the beginning of 1905, when, with the exception of a short inland line—from Bonny to Old Calabar, a distance of about 117 miles—constructed but a short time before, the Colony was in communication with Europe only, by cable from Lagos, Brass and Bonny.

Currency.—The coin of the realm is legal tender everywhere, but in certain parts which are not yet under effective control and where the natives are shy of its acceptance, the currency of the country, regulated by law, is permitted to continue. The Native currency consists of brass rods and copper wire, in Old Calabar, and the Cross river districts ; Manillas (*see* below), in Bonny and the Niger delta ; the Maria Theresa dollar† (Province of Bornu chiefly, mean value 3s. in 1906) ; slaves and cowries in Northern Nigeria, cowries in Southern Nigeria, tobacco, cloth, mirrors, &c. are also used for exchange.

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* Col. Rep., Ann., No. 476, 1905, p. 88, N. Nigeria.

† The Maria Theresa dollar is of Austrian origin, and is the currency of Abyssinia, Eritrea, and the Eastern Sudan. According to Professor W. Ridgeway (Origin of Currency, and Weight Standards, 1892, p. 56), "The Arabs of the Sudan will not take gold as payment, in consequence of which our army in the late expedition had to take with them large and inconvenient supplies of silver dollars, coined for the purpose. The Maria Theresa dollar is the recognized currency in that region, not because of any notions as regards currency, properly speaking, but because the Arab's taste lies in silver ornaments for himself, his weapons, and his horse. Gold he cannot employ to the same advantage."

The rate of exchange for brass rods is 3d. each or four to the shilling, and 19 copper wires (Citims) are equal in value to one brass rod *; Manillas† are of different values, Abbie or Prince Manillas and Atorni or Wa-a-hono Manillas are valued at the rate of 12 for one shilling, Ama-ogono at 24 for a shilling and Awirawu Manillas at 6 for a shilling sterling. Cowries also vary in value, 1,000–2,000, and even as many as 3,000 may be reckoned for one shilling. The slave currency in Northern Nigeria was usually only employed over large deals, and this form will now pass away automatically with the abolition of slavery.

Further importations of all the metallic forms of currency have been prohibited and also the cowries. With a view to their ultimate replacement, a subsidiary coinage of nickel-bronze pennies (Nigerian pennies) and aluminium tenths of a penny has recently been approved and circulated.

BOTANY.

The Niger Flora, by Sir W. J. Hooker and Mr. George Bentham, published in 1849, was the first important work in connection with Tropical Africa. It was based chiefly on the collections made by Dr. Theodore Vogel and Mr. Ansell during the Niger Expedition of 1841, and the plants described therein are now embodied in the Flora of Tropical Africa.

The preparation of the Flora of Tropical Africa, at the Royal Botanic Gardens, Kew, was sanctioned by the Treasury in 1864, and three volumes were published under the editorship of Professor D. Oliver between 1868 and 1877. The work then fell into abeyance, but in 1891, at the request of Lord Salisbury, its preparation was resumed under the editorship of Sir W. T. Thiselton-Dyer. Seven of the nine volumes (one being in two sections) have now been published, and the two remaining volumes, 6 and 9, are in course of preparation.

The following brief summary‡ of the whole work shows the condition and progress made up to 1906 :—

"The conclusion of the fourth Volume of the *Flora of Tropical Africa* affords an opportunity for briefly summarising the whole of its contents with regard to the progress which it marks in the botanical survey of tropical Africa.

"When, in 1891, it was decided to resume the preparation of the *Flora of Tropical Africa*, one volume was assigned to the orders *Oleaceae* to *Pedaliaceae* of Bentham and Hooker's 'Genera

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* The difficulties of transport are much enhanced by currency of this nature. The Rods weigh each 8 ozs., and are approx. ¼-inch wire, 3 ft. long and bent round to a length of 18 ins. Calculating 60 lbs. to a load for one man this would mean 120 rods (30s.), but being dead weight, 100 rods so far as I remember, were considered sufficient for a load. The wires are about 2 ft. 6 ins. long bent in half like the rods, and weigh barely half an ounce, the 19 weighing just about 8 ozs.

† The Manilla resembles an ancient Irish Bronze Fibula.

‡ Kew Bulletin, 1906, pp. 240–241

Plantarum.' At that time the number of species of those orders recorded as occurring in Tropical Africa might have been estimated at somewhat over 700. Volume III. contains 1,134 species. Allotting to volume IV. approximately the same number of species, there was therefore a margin for 400 additional species, corresponding to an increase of 60 per cent. But so extraordinary was the accession of new material during the progress of the preparation of volume IV., that in the end the number of species of the orders reserved for it rose to 2,176, double the original estimate. That, of course, necessitated the subdivision of the volume into two parts, each equalling in size an ordinary volume. The increase was very unequal in different orders—as will be seen from the list given below—varying in the larger orders (of over 100 species) from slightly over 50 per cent. in *Solanaceae* to well over 300 per cent. in *Apocynaceae*, and almost 600 per cent. in *Loganiaceae*. The significance of these figures will perhaps more readily be grasped when we consider that the increase from 813* species known before 1891 to 2,176 known at present means that for every three species then known, five species have since been added ; and if we assume that the same proportions hold good in the case of the orders dealt with in the first three volumes of the *Flora of Tropical Africa*, these orders would, if worked out at present, fill at least eight volumes. That this is by no means an exaggerated view may be seen from the fact that the Tropical African *Myrsinaceae* and *Sapotaceae*, which in the third volume (1877) numbered 11 and 23 species respectively, are, in recently published monographs, represented by 36 and 92 species respectively.

"This phenomenal increase of our knowledge of the flora of Tropical Africa since 1891 has been due to several causes. Old collections of very considerable extent which had only casually and partially been studied have now been worked up systematically (*e.g.*, Barter's West African, Schweinfurth's Sudan, and Welwitsch's Angola collections) ; fresh collections have poured in as new countries were opened up or the establishment of botanical stations in the older colonies facilitated a more exhaustive exploration of their neighbourhood ; finally it was just then that Germany started with remarkable and well-directed energy on the botanical survey of her colonies, with the result that in not a few orders 50 per cent. or more of all the additions from recent collections are due to her enterprise."

Since it is of the first importance from the practical point of view, that plants of commercial value should be identified both botanically and under their native names, it is necessary that all specimens collected in the country should be preserved as carefully as possible and that the native names should in all cases be recorded.

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* These figures include a number of species which, although known prior to 1891, were not recorded from Tropical Africa until after 1890. To make out their exact number would have taken more time than could reasonably be spared ; but it probably does not exceed 70 or 80, so that the species of the orders inquestion which were known from Tropical Africa at the end of 1890 may be estimated as somewhat over 700.

The following details as to methods of collecting are therefore included :—

COLLECTION OF SPECIMENS.

I. *Horticultural Department.*

Plants for cultivation may be introduced : (1). As **Seeds, Bulbs, Tubers,** or **Rhizomes,** all of which are easily collected and transmitted. **Seeds** should be collected when quite ripe, and each kind packed separately in paper or other material so as to insure their not becoming mixed with others. Small seeds of a dry nature containing little or no oil may be packed in small paper or canvas bags, and sent by parcel post. This is by far the best means of sending home small quantities of seeds, &c., on account of their early despatch and delivery. Oily seeds, such as those of most of the *Magnoliaceae*, many of the Palms and *Leguminosae*, and also of Para Rubber, quickly lose their power of germination. These are best transmitted in tin or other close-fitting boxes, packed in moist but not wet soil. **Bulbs, Tubers, and Rhizomes,** should be dug up when the foliage has withered at the end of the growing season, and packed in a dry state in a wooden box in such a manner that they cannot move about, as they are very liable to damage if bruised during transit.

(2). **Cuttings.**—Ripened growth of many succulent plants such as Cacti, Euphorbias, Senecios, Stapelias, &c., may be safely collected and sent home in this way. The cuttings should be taken off where there is a constriction or articulation of the stem, and laid out in the sun for a short time to free them from extraneous moisture, and should then be tightly packed in a stout box in dry paper or some other elastic substance to keep them from bruising one another. Wood shavings, if carefully dried, are an excellent material for this purpose.

(3). **Rooted Plants.**—Many succulent plants, such as Cacti, Aloes, Agaves, Bromeliads, and Cycads, also many Orchids, will safely undergo a long journey if prepared and packed in the way advised for cuttings. Many plants, however, cannot be treated in this way, such as those of slender growth and evergreen habit which are not capable of retaining sufficient moisture in their stems or roots to enable them to withstand a long journey. On account of the great difficulty experienced in transmitting this class of plants, they should be packed in a small portable greenhouse, known as a Wardian case. The bottom of the case should be covered with 4 in. to 6 in. of soil, and the young plants planted in it in rows and watered carefully until established. When ready for despatch the surface of the soil should be tightly fastened down by strips of wood carefully nailed in position. The object of this is to prevent the soil and plants from being displaced should the case be overturned. It is important that this operation should be done carefully, otherwise the plants may shake loose and suffer much damage during transit. The glazed lid should then be fastened on with screws and putty, and the address carefully written or stamped on the end, adding also the words "ON DECK UNDER AWNING." The plants should require no water or attention unless the glass be broken during the voyage.

II. Museum Department.

Among the objects which should be collected for Museum purposes are :—

1. **Fruits and Seeds,** especially those which are of large size, or possess any peculiarity of form or structure entitling them to notice. Many of these are naturally dry and require little care (except to be freed from moisture) previous to packing. Those that, when ripe, burst open into valves, or separate by their scales, as Pine-cones, &c., should be bound round with pack-thread. The soft and fleshy fruits can only be preserved in wide-mouthed bottles, or jars, or casks (according to size) in alcohol, as rum, arrack, or in diluted pyroligneous acid or strong brine. Formalin is also a very convenient medium, a 5 per cent. solution or 20 parts water to 1 of Formalin, being generally sufficient.

2. **Entire Plants,** or parts of them. Many have a very fleshy character and ought to be preserved entire in alcohol ; or portions of the stems and branches (according to their size) with flowers and fruit ; such as those of Palms, Stapelia, Rafflesia, and others of a similar kind.

3. **Trunks of Trees,** portions and sections of them, especially when they exhibit any remarkable structure : as Palms, and many other Monocotyledonous plants, and Tree Ferns. Specimens of wood should be in sections, a foot or more long, and about the average diameter of the tree. The kinds used in commerce for veneering, cabinet-work, or other useful purposes, or such as recommend themselves by their beauty, hardness, or any other valuable quality, are particularly desired. The scientific or other names, if known, should be attached, and specimens of the leaves and flowers should be sent so as to admit of their identification.

4. **Gums, Resins, and Vegetable Waxes,** especially those employed in the Arts or in Domestic Economy.

5. **Dye Stuffs** of various kinds.

6. **Medicinal Substances.** These are of vast importance, and merit the attention of travellers in every country. With regard to many it is not yet known, except by the natives who collect and prepare them, what are the particular plants that afford them, nor how they are prepared.

7. **General Products of Vegetables** ; in the state of the raw material, and manufactured. It would be extremely difficult, not to say impossible, to enumerate all of these which a Museum ought to contain ; but the enlightened traveller can form a pretty correct judgment. Such as are useful to mankind cannot fail to be interesting. It would be idle to send every well-known object of this kind, tea, sugar, coffee, cocoa, chocolate, pepper, textiles, plaiting, basket-work, clothing, &c. ; but there are states even of these familiar articles which may prove both useful and instructive.

In case of samples of timber, of various fibres, dye-stuffs, drugs, or any other vegetable product, it is of the first importance that there should be sent along with each example a dried specimen of the leaves and flowers of the tree or plant affording the same, marked distinctly with a corresponding number, so that the source of the product may be scientifically determined. Through want of such dried specimens accompanying the timbers, drugs, fibres, &c., which have been sent to the Royal Gardens, a large number are absolutely useless.

III. Herbarium Department.

Collecting.—For the collection of specimens a tin box or *vasculum*, made to shut close, to prevent evaporation, is necessary. Such boxes can be made of aluminium, and are much lighter than those usually sold for the purpose. A portfolio containing some sheets of drying-paper is also useful for certain plants, like some *Scitamineae* or *Iridaceae*, with very delicate flowers, which should be placed under pressure when gathered. Each specimen should consist of as much of the plant as will adequately represent its habit, foliage, flowers, and fruit, where possible; if small, the whole plant including the root should be obtained; if large, portions which can be laid upon a sheet of paper 16 ins. long by 10 ins. broad should be procured. Tall plants or slender stems, such as grasses, sedges, fern-fronds, &c., may be doubled once or twice into 16 in. lengths. Specimens without flowers or fruit are worthless and should not be collected. If the specimens are wet when gathered, the moisture should be allowed to evaporate before placing them in the press; otherwise, they are very liable to be spoilt by mildew.

Labelling.—Every species collected should be accompanied by a label bearing a number and particulars as to locality, altitude, colour of the flowers and any character of the plant which the specimen does not show, such as whether it may be a branch from a tall tree or from a small shrub, the date when collected and name of the collector. A collector should never use the same number twice, and each specimen should have a different number. If several specimens of the same plant, collected at the same place are put in the press together, only one of them need be labelled, but the number upon the label should be written upon pieces of paper and placed with the other specimens, so that when dried all can be referred to the same label.

Labels should be after the pattern and size shown below :—

FLORA OF SOUTHERN NIGERIA.

No.

Name.

Vernacular Name.

[*Space for notes by collector as to colour, scent, habit, time of flowering, fruiting, uses, &c.*]

Locality.	Date.
Altitude.	Collector's Name.

The locality should be given in such a way as to be at least approximately noted on a good map.

Drying.—To preserve plants for permanent collections, the collector should endeavour to thoroughly dry the specimens in such a manner that the natural pose and colours of the plant are preserved as far as possible, and sufficient pressure should be applied to prevent them from shrivelling or curling up whilst drying. For this purpose a quantity of stout, moderately absorbent paper of ordinary demy size (17 in. by 10) when folded, and two or more stout frames of wire grating of the size of the paper are required, or the frames may be of wood lattice-work, made of strips of wood ⅜ in. thick, crossing each other at right angles and nailed together.

To form the press, first make the pressing paper up into pads of two or three folded sheets placed inside one another. Place a pad upon one of the wire or wooden frames, arrange upon the pad (not between its folds) the specimen to be dried, or as many specimens as the size of the pad will permit, side by side, never one upon another, then arrange pads and specimens in alternating layers. Care should be taken to turn some of the leaves of the specimens to show the undersurface, and also, when possible, to spread out the parts of some of the flowers. In the case of plants with very delicate petals it is desirable to dry some of the flowers separately and place them in a capsule bearing the same number as the corresponding complete specimens. Upon the top of the pile thus formed place another wire or wooden frame, and apply pressure. A heavy weight may be used for this purpose, but it is far better to use a pair of strong leather straps. With the latter method the bundle can be placed at any angle to the sun's rays, or be swung in the open air, so that the wind can carry off the moisture. The perfection of a specimen depends upon the rapidity with which it is dried. During the rainy season in the tropics it is often necessary to dry the plants near a fire. The paper pads will require changing with more or less frequency, according to the nature of the plant, and the damp pads must be spread out to dry. Grasses, sedges, many ferns, mosses, and many cryptogamic plants are easily and quickly dried, and give very little trouble. Water plants should be changed into dry pads about two hours after being placed in the press, when three-fourths of the water about them will be absorbed by the pads between which they were first placed, and they then dry quickly and with less liability to be destroyed by mildew. Succulent plants, or those with thick or more or less fleshy stems or leaves, often require changing every day ; but experience is the only guide in such cases. Plants with thick fleshy stems, like Cacti and some Euphorbias, should be prepared for pressing, as follows :—First cut a few thin transverse slices of the stem to show its form, press these separately, and under considerable pressure to prevent distortion ; next make a thin longitudinal section, which should include two opposite angles with their spines, &c., if such are present ; the cut-off sides should also be preserved with as much as possible of their pulp cut away. Thick stems of Orchids or other plants should also be cut in half longitudinally. Plants with tuberous or bulbous roots should have a central longitudinal slice taken through the tuber or bulb with the stem and leaves attached—this reduces thickness, and the outer coats or skin of the parts cut away should also be preserved. Thick leaves like those of *Agave* and *Aloe* should have a few thin transverse sections made at the base and middle, then a leaf should be laid with its upper surface downwards, and the under skin and all the pulp of the leaf removed, leaving only the upper surface of the leaf ; care should be taken that the margin and any prickles upon it remain intact ; the sections and upper surface of the leaf are all that it is necessary to preserve. If the leaf is over 16 in. long it may be cut into 16 in. lengths and the pieces numbered in ink, so that it may be reconstructed when dry. Succulents prepared in this way dry better and much more quickly than if unprepared. Seaweeds should be slightly washed in fresh water, and the delicate kinds should be floated out upon sheets of white paper before they are subjected to pressure.

The pile composing the press should not be too thick, it is better to have two or three thin presses than one very thick one. Plants that are partly dried should be kept separated from those freshly placed in the press by the intervention of another frame or other means. When the specimens are perfectly dry, remove them from the press, place upon sheets of paper (newspaper will do) with their labels, tie up in bundles and keep in a perfectly dry place. In order to prevent the destruction of the specimens by insects it is advisable to sprinkle powdered naphthalene between the sheets of each bundle in some quantity. For transmission the bundles should be tightly wrapped in oiled cloth.

COLLECTORS IN NIGERIA.

In the following list are given the names of the collectors who have contributed specimens from Nigeria, either to the Royal Gardens, Kew, or to the British Museum. Although the period covered is from the early part of the XIXth Century to the present time the list is by no means a long one.

Any genera named in honour of these collectors are also given in brackets under the names.

Mungo Park, A.L.S. (Travelled in Africa, 1795–7, 1804–5); died on the Niger, 1805. [*Parkia*, R. Br.]

Captain Hugh Clapperton, R.N. (1822–1824) died April 13, 1827, buried at Jungeri, Sokoto province ; was the first European to visit Sokoto, March 16, 1824. [*Clappertonia*, Meisn.=*Honckenya*, Willd.]

Lieut.-Col. Dixon Denham (1822–1824), died, Sierra Leone, May 8, 1828. [*Denhamia*, Schott=*Culcasia*, R. Br.]

Walter Oudney, M.D. (1821–24) collected in Bornu ; died at Murmur, W. Sudan, January 12, 1884. [*Oudneya*, R. Br.]

Dr. Theodore Vogel (1841) collected chiefly near Lokoja.

John Ansell (1841) collected with Dr. Vogel on the Niger Expedition. [*Ansellia*, Lindl.]

Edward Vogel (1851–55) collected in Bornu.

Edward George Irving, M.D., Surgeon, R.N. (1844–1855) collected in Abeokuta, &c. [*Irvingia*, Hook. f.]

Miss Gurney (1855) Lagos.

Dr. William Balfour Baikie (1855–64) collected in Nupe, &c. [*Baikiaea*, Hook. f.]

Charles Barter (1857–1859) collected in the neighbourhood of Rabba, Nupe and Borgu; died at Rabba, July, 1859. [*Barteria*, Hook. f.]

Gustav Mann (1860) collected in Old Calabar, Bonny, &c.

Rev. William C. Thomson (1863) collected chiefly about Old Calabar.

William Grant Milne (1862–66) collected on West Coast of Africa; died at Creektown, Old Calabar, May 3, 1866.

W. Kalbreyer (1877–1884) collected in the Niger Delta.

Rev. Hugh Goldie (1888) collected chiefly in Old Calabar district and first brought to notice the remarkable *Aristolchia Goldieana*; died and buried at Creektown, Old Calabar.

Sir H. H. Johnston, G.C.M.G. (1888) Cross River.

Walter Higginson (1890) Lagos.

Alvan Millson (1890–1891) Lagos and Yoruba.

Dr. John William Rowland (1890–93) collected in Lagos.

Sir George Chardin Denton, K.C.M.G. (1895) when Deputy Governor of Lagos.

Sir Alfred Moloney, K.C.M.G. (1882–1896) collected in Lagos when Governor of that Colony.

Henry Millen (1892–96) Curator of the Botanic Garden, Lagos.

Horace Walter Leighton Billington (1893–1897) First Curator of Botanic Gardens, Old Calabar, died Old Calabar, November, 1897.

John Henry Holland (1897–1900) Curator, Botanic Gardens, Old Calabar, 1897–1901.

Captain Arthur Johnstone Richardson (1898) collected chiefly near Lokoja.

Harold Buchan Lloyd (1898) Assistant Curator, Botanic Gardens, Old Calabar.

Dr. Ernest Ule (1899) Old Calabar.

T. B. Dawodu (1899) Lagos.

Cyril Punch (1900) First Superintendent of Forests, Lagos.

L. Kentish Rankin (1901) Northern Nigeria.

Sir William MacGregor (1901) when Governor of Lagos.

W. R. Elliott (1903) Conservator of Forests, Northern Nigeria; collected in various parts from the Lagos frontier to Lake Chad. Died March 13, 1908, at Bedford whilst on leave.

P. H. Talbot (1904) Northern Nigeria, collected on a surveying expedition from Ibi on the Benue to Lake Chad, through Bauchi.

Captain G. B. Gosling (1904) Northern Nigeria. Benue to Lake Chad.

Dr. J. M. Dalziel (1905) collected at Lokoja, Zungeru, Kontagora, &c.

Norman C. MacLeod (1905) Deputy Conservator of Forests, Southern Nigeria.

H. N. Thompson (1906) Conservator of Forests, Southern Nigeria.

Dr. A. H. Unwin (1906) Assistant Conservator of Forests, Southern Nigeria.

E. W. Foster (1906) Curator, Botanical Department, Lagos, afterwards Assistant Conservator of Forests.

J. C. Leslie (1906) Assistant Conservator of Forests, Asaba, Southern Nigeria.

Col. E. J. Lugard, D.S.O. (1907) Zungeru and Lokoja, Northern Nigeria.

G. C. Dudgeon (1907) Superintendent of Agriculture, West Coast of Africa.

R. E. Dennet (1907) Assistant Conservator of Forests, Southern Nigeria.

H. Dodd (1908) Curator, Botanical Department, Southern Nigeria.

The result of the efforts of recent collectors may be seen by reference to the Kew Bulletin (No. 6, 1907) in which the accession of Tropical African Plants to the Herbarium from 1899–1906 is given, for it appears from this report that 14,627 specimens in all were received, 10,000 of which were unnamed and had to be identified. A good proportion of these were from Nigeria. The lower Cryptogams (Mosses, Liverworts, Algae, Lichens, Fungi) are not included in the figures given, for the simple reason that they have been almost completely neglected by the collectors.

BOTANIC GARDENS.

LAGOS.

The Botanic Station at Lagos was formed in 1887, and was the first of its kind established on the West Coast of Africa.

In a memorandum drawn up by Capt. (now Sir Alfred) Moloney, the Governor, together with Mr. (now Sir William) Thiselton-Dyer, Director of the Royal Gardens, Kew, the objects were stated to be :—

"The growth of specimens of indigenous trees and plants of marketable value (or likely to prove so) that may serve on development as visible means of instruction to the natives of the Colony, and of the interior Kingdoms who visit the Government from time to time."

"A Practical Agricultural School to be the means of diverting some of the young blood of the country in the direction of Agricultural pursuits and so lessen the general tendency of the rising educated youths to become 'merchants and clerks.'

"An established centre for the introduction and subsequent development of alien elements of Economic botany of commercial importance elsewhere."

"A nursery for Economic tropical plants of commercial importance."

"Such an enterprise must anticipate what commercial benefit may in a few years be brought about by the steady distribution of young trees of Economic value among the Chiefs and people of the many villages that border the network of water which permeates the Colony and its neighbourhood."

Further the Superintendent was to direct his efforts to—

"(*a*) Promotion of extension of growth of the Cocoa-nut palm.

(*b*) Introduction of a better class of Cotton and its extended growth."

(*c*) Culture of the naturalized tobacco and improvement therein by importation of suitable seed.

(*d*) Growth of ginger, cacao, pepper (red), and coffee.

(*e*) Development of the rubber, gum, and resin trees, and of fibres.

(*f*) Growth and judicious planting of Eucalyptus, Melaleucas, and the Casuarinas.

(*g*) Model Kitchen Gardening."

He was also to consider the apprenticeship of Refugee (ex-slave) boys; the industrial education of sons of Chiefs; sale of plants; and the gratuitous distribution under the authority in writing of the Governor, whenever of advantage to the general interest.*

The site selected was at Ebute Metta on the mainland, and the area of land enclosed was 3¾ acres.

Mr. James McNair, from the Hope Nurseries, Kingston, Jamaica, commenced his duties as the first Superintendent on the 8th November, 1887.

The original cost of the Department was moderate. The yearly estimate was about £300, including salary of Superintendent £100–£150 (with Quarters), Gardener £30; two labourers 1*s*. per day each; tools and incidental expenses.

Particulars of the Economic plants mentioned in the scheme of operations and in later reports will be given under the botanical name of each subject. The general progress of the garden during its first year is shown by the following report. On the 12th November, 1888, Sir Alfred Moloney in a despatch to Lord Knutsford, states, "Your Lordship will observe that the reasons advanced in favour of the establishment of a botanic centre in this Colony have been within a year supported by the attainment of the objects on account of which the institution was advocated."[*] The Superintendent in his report for the quarter ending 30th September, 1888, records the fact that an important part of the original scheme had been carried out by the establishment of a model Kitchen Garden. Twenty large beds had been laid out and planted. A contractor had been found to take for one quarter the vegetables in excess of the requirements of the Superintendent at a nominal rate of £2 per month.

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* Kew Bulletin, 1888, pp. 151, 152.

"The issue of plants from the garden for the quarter under consideration reached a total of 4,569 ; of this number 3,770 were purchased, and payment to the sum of £7 17s. 1d. made accordingly into the Treasury, the balance represented free issues.

"For instruction in accordance with the original scheme there was introduced into the Garden on the 14th September one Gbaini, the nephew of Chief Manuah of Itebu."[†]

Some additional evidence of the demand for such an institution is afforded in the following extract from a despatch by Mr. F. Evans, C.M.G., acting Administrator of Lagos to the Secretary of State, dated the 27th of May, 1887, on the possibilities of a trade in fruit. It was stated, "there is not sufficient fruit of any kind grown in or near Lagos to enable exportation for trade purposes to take place, and what is grown is mostly of an inferior quality, no attention being paid to its cultivation, and although limes, sweet oranges, and tamarinds might possibly be extensively cultivated and preserved for exportation, the length of the voyage between here and Europe precludes the possibility of fresh fruit." The Kew Bulletin for 1888 states[‡] that "fruits grown in the Colony are capable of being produced in much larger quantities, but the natives do not understand the cultivation or the method of preserving ; and consequently there is no inducement among the local traders to open up or extend a trade in fresh or preserved fruits."

At the end of 1890 Mr. James McNair resigned, and was succeeded by Mr. Henry Millen from the Royal Gardens, Kew.[§]

In 1892 it was recorded[||] of the department that since the inception in 1887 considerable success had been attained in cultivating plants received from Kew and elsewhere, and large numbers possessing industrial value had been distributed, and that under the joint authorship of Mr. Millen and Dr. Rowland, the Colonial Surgeon, a printed list was published of the plants (443 in number) cultivated at the station.

Perhaps the next stage worth noting in the history of the botanic station was a suggestion to convert it after ten years of useful work into a model farm, and the following extracts from official correspondence on the subject will convey sufficient evidence as to the reasons advanced for and against the change.

Col. Sir Henry McCallum, the Governor of Lagos, in a despatch to the Secretary of State for the Colonies, dated 19th of August,

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[*] Kew Bulletin, 1889, p. 69.
[†] l.c., pp. 70, 71.
[‡] Kew Bulletin, 1888, pp. 224, 225.
[§] Kew Bulletin, 1891, p. 46.
[||] Kew Bulletin, 1892, p. 314.

1897,* stated, "as regards the cultivation of tropical products I am sorry to say that the result of enquiries in the best informed quarters is a general opinion that we shall be unable to get the natives to take up anything of commercial importance until they actually see plantations of the same growing, and in some cases yielding returns under Government control and supervision. At present they are, as a rule, content with forest produce, and with planting fast-growing food stuffs for immediate consumption.

"A few trees and shrubs in a botanical garden give them no idea of how the same should be worked and cultivated as a plantation, and when they do purchase coffee or cocoa plants they generally soon lose them from sheer neglect.

"I propose for your consideration that in 1898 we should select a well-watered fertile tract of ground in a conveniently central situation, and that we should establish there an experimental model farm, at which there should be blocks of from two to four acres each of such crops as different sorts of rubber, tobacco, coffee, pepper, gambier, kola nut, tapioca, cotton and indigo.

"Such a farm would not only be an object lesson for the instruction of the natives, but would be the distributing centre for plants and seeds for extension and development of such agricultural enterprises as might be found suitable and successful."

The expenses for the year (1898) were estimated at £2,000 for the model farm and £2,000 for the encouragement of agricultural enterprise.

The Secretary of State, while appreciating the importance of the subject, considered that it was doubtful whether it would be possible to incur any new charges of the kind suggested, having regard to the other pecuniary liabilities which the Colony was then assuming.

Reviewing these suggestions the Director of Kew† considered the scheme likely to prove a costly one and beyond the financial resources of the colony.

The establishment of a model farm was left in abeyance till November, 1899, when it was taken up again by Sir William MacGregor, the next Governor of Lagos, who, in a despatch to the Colonial Office‡ with reference to the subject in conjunction with the botanic station, stated: "It appears to me somewhat doubtful whether the finances of the Colony could bear the continuance of this establishment (botanic station) concurrently with the model farms.

In view, however, of the clearly expressed opinion of Sir W. T. Thiselton-Dyer that the botanic station should be maintained, the vote has been continued. It is intended to establish a new botanical station at some suitable place, as Ebute Metta is now cut up by the railway. The spot selected will be, if possible, contiguous to the model farm to be opened in Abeokuta territory, so that the two Managers could assist or relieve each other."

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* Botanical Enterprise in West Africa, 1889–1901, p. 46.

† Botanical Enterprise in W. Africa, 1889–1901, pp. 49, 50 and 51. Letter to Colonial Office, Dec. 31st, 1897.

‡ Botanical Enterprise in West Africa, 1889–1901, p. 159.

A model farm had already been started (1899) in conjunction with a forest reserve (about 4,000 acres of forest land) at Ibadan, on a smaller scale than that previously described, and although it was intended to serve as an object lesson to the natives, its chief aim lay in the propagation of rubber and timber trees for reafforestation. The farm was under the superintendence of Mr. Cyril Punch, who had some time before been constituted Inspector of Forests.

Ultimately another model farm was founded (1901) at Oloke-Meji, in the Abeokuta territory, about 93 miles from Lagos, and it was at this place also that the site for the new botanic station was selected. Mr. Edgar William Foster of the Royal Gardens, Kew, was appointed Curator of the Department, March, 1901.

Mr. Millen, it may be mentioned, resigned in 1908 and was appointed Curator of the Botanic Station at Tobago. The Ebute Metta Station had in the meantime been looked after by Messrs. Leigh and Dawodu, the assistant Curators, natives of the Colony, who had received their training in the West Indies and at Kew. Mr. Foster was transferred to the Forestry Department as Assistant Conservator, in 1906, and was succeeded (1906) as Curator by Mr. John Lloyd Williams, of the Royal Botanic Gardens, Kew. The Department came under the control of the present Conservator of Forests (Mr. H. N. Thompson) on the amalgamation of the Forestry Departments of Lagos and Southern Nigeria, 28th June, 1905.

Some idea of the nature of the work being done in 1905 may be gathered from the following extract from the report for that year;[*] and incidentally it shows that the original botanic station had not been entirely abandoned.

"The Botanical Gardens both at Oloke-Meji and Ebute Metta were well maintained during the year, especially the former, which is being increased and has supplied the bulk of the plants distributed. The work of distribution is becoming heavier every year, and it alone practically takes up the whole time of one European Officer." Again, in 1906, it is reported[†] that "a large number of plants of economic importance were distributed during the year from the Oloke-Meji Gardens to farmers and others interested in their cultivation."

It is also satisfactory to note in the same report that a systematic course of instruction is given at the Gardens. The course covers a period of three years, and the pupils are instructed "in the propagation of plants, the essential conditions requisite for good growth, pruning, elementary botany, farming, and plantation work in the forests."

"After the completion of the course the best pupils are given appointments in the more important Native States and Districts."[‡]

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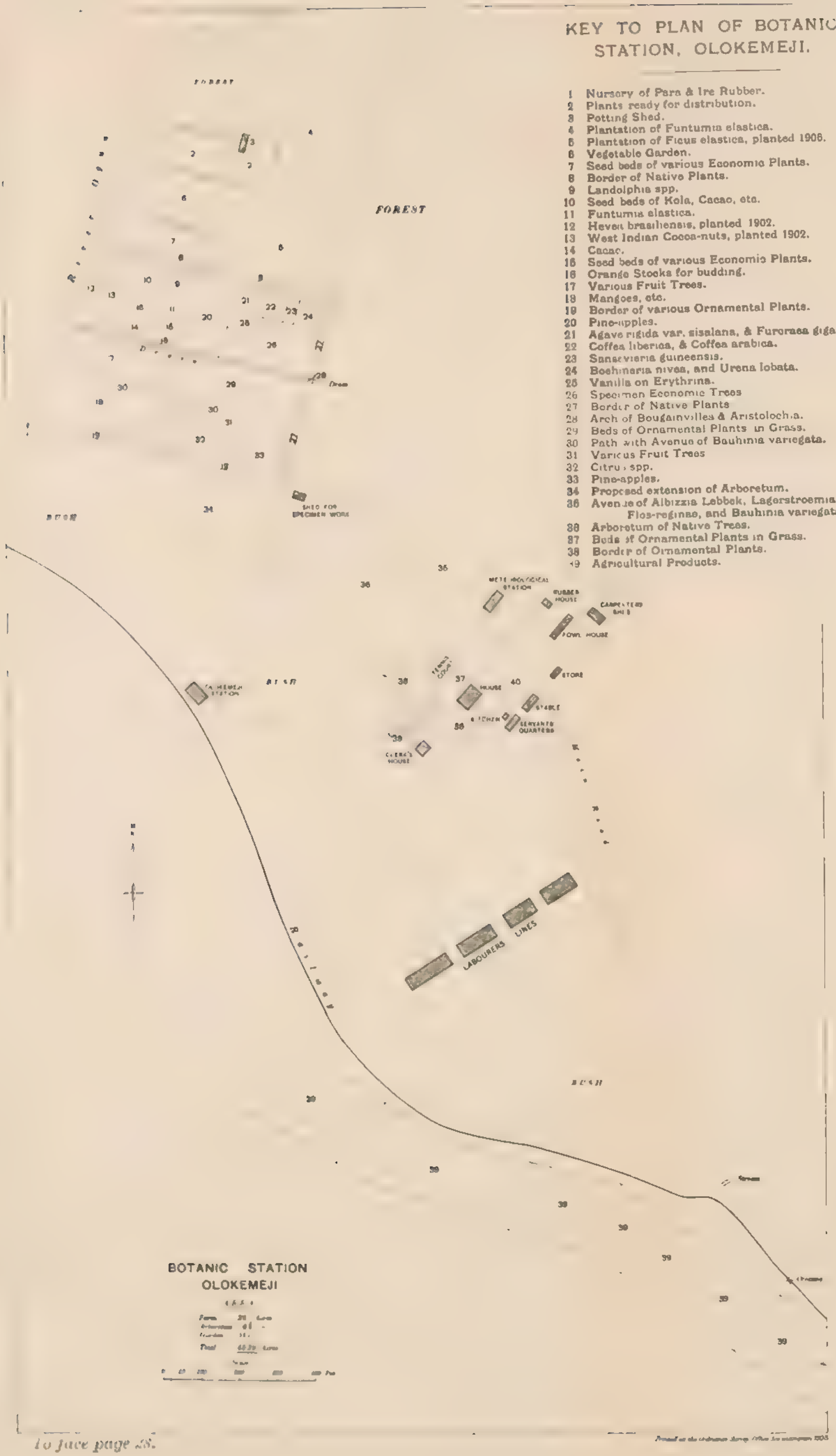
[*] Col. Rep., Ann., No. 507, S. Nigeria, 1906, for 1905, p. 25.
[†] ,, ,, ,, No. 554, ,, 1908, for 1906, p. 41.
[‡] It is of interest to notice in this connection that four pupils are now (1908) wanted for the Forestry and Agricultural Department, Western Province, at a salary of £20 per annum. Govt. Gaz., S. Nigeria, Sept. 23rd, 1908.


FOREST
FOREST
BUSH
BUSH
BUSH
SHED FOR SPECIMEN WORK
METEOROLOGICAL STATION
RUBBER HOUSE
CARPENTERS SHED
FOWL HOUSE
STORE
HOUSE
STABLE
KITCHEN
SERVANTS QUARTERS
CLERK'S HOUSE
LABOURERS LINES
Railway
Stream

KEY TO PLAN OF BOTANIC STATION, OLOKEMEJI.

1 Nursery of Para & Ire Rubber.
2 Plants ready for distribution.
3 Potting Shed.
4 Plantation of Funtumia elastica.
5 Plantation of Ficus elastica, planted 1906.
6 Vegetable Garden.
7 Seed beds of various Economic Plants.
8 Border of Native Plants.
9 Landolphia spp.
10 Seed beds of Kola, Cacao, etc.
11 Funtumia elastica.
12 Hevea brasiliensis, planted 1902.
13 West Indian Cocoa-nuts, planted 1902.
14 Cacao.
15 Seed beds of various Economic Plants.
16 Orange Stocks for budding.
17 Various Fruit Trees.
18 Mangoes, etc.
19 Border of various Ornamental Plants.
20 Pine-apples.
21 Agave rigida var. sisalana, & Furcraea gigantea.
22 Coffea liberica, & Coffea arabica.
23 Sansevieria guineensis.
24 Boehmeria nivea, and Urena lobata.
25 Vanilla on Erythrina.
26 Specimen Economic Trees
27 Border of Native Plants
28 Arch of Bougainvilles & Aristolochia.
29 Beds of Ornamental Plants in Grass.
30 Path with Avenue of Bauhinia variegata.
31 Various Fruit Trees
32 Citrus spp.
33 Pine-apples.
34 Proposed extension of Arboretum.
35 Avenue of Albizzia Lebbek, Lagerstroemia Flos-reginae, and Bauhinia variegata.
36 Arboretum of Native Trees.
37 Beds of Ornamental Plants in Grass.
38 Border of Ornamental Plants.
39 Agricultural Products.

BOTANIC STATION
OLOKEMEJI

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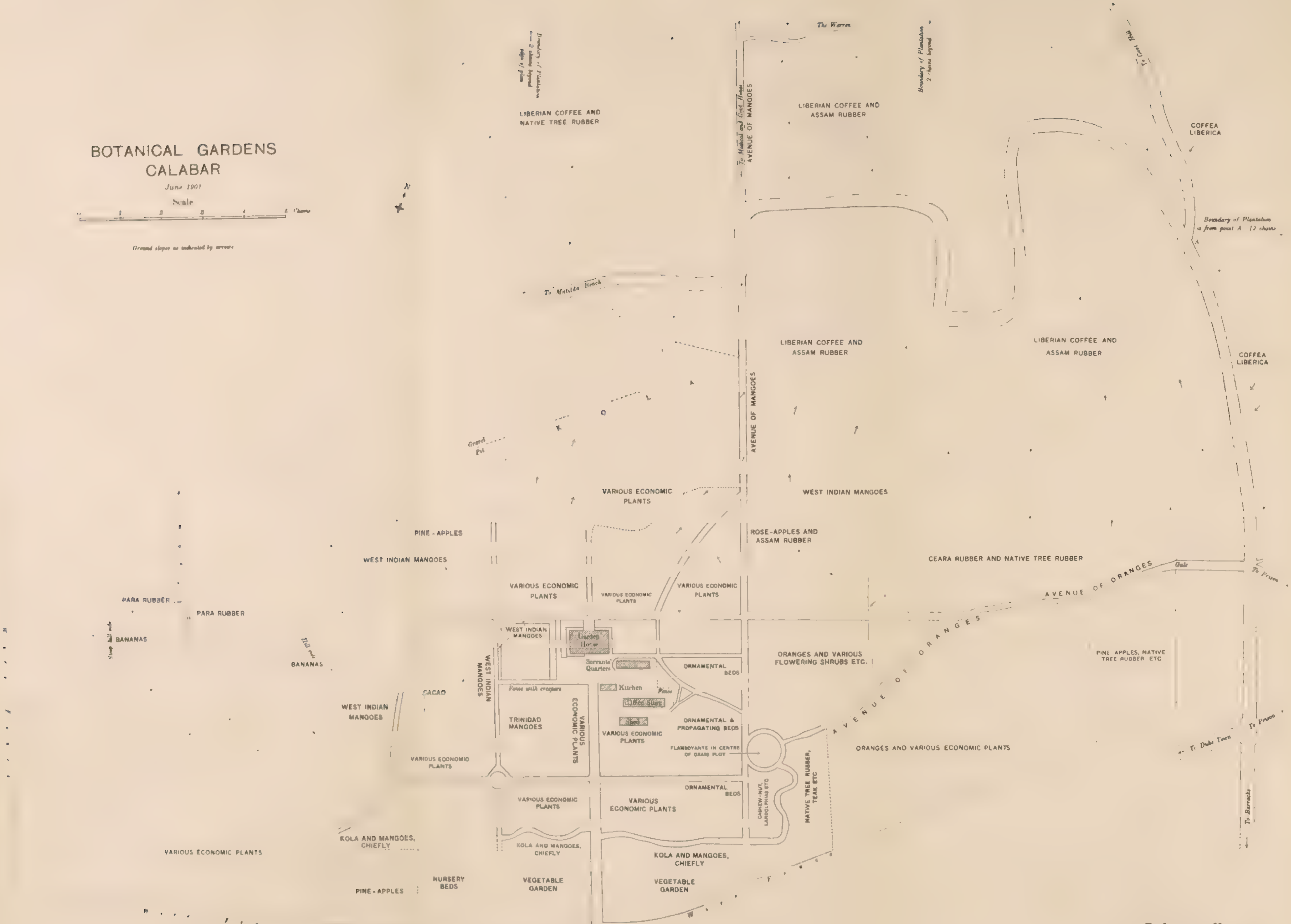
BOTANICAL GARDENS
CALABAR
June 1907
Scale
0 1 2 3 4 5 Chains
Ground slopes as indicated by arrows
N
The Warren
Boundary of Plantation 2 chains beyond
To Medical and Govt House
AVENUE OF MANGOES
LIBERIAN COFFEE AND NATIVE TREE RUBBER
LIBERIAN COFFEE AND ASSAM RUBBER
To Govt Hill
COFFEA LIBERICA
Boundary of Plantation is from point A 12 chains
A
To Matilda Beach
Gravel Pit
K
O
L
A
LIBERIAN COFFEE AND ASSAM RUBBER
LIBERIAN COFFEE AND ASSAM RUBBER
COFFEA LIBERICA
VARIOUS ECONOMIC PLANTS
WEST INDIAN MANGOES
PINE-APPLES
ROSE-APPLES AND ASSAM RUBBER
WEST INDIAN MANGOES
CEARA RUBBER AND NATIVE TREE RUBBER
Gate
To Bridge
AVENUE OF ORANGES
VARIOUS ECONOMIC PLANTS
VARIOUS ECONOMIC PLANTS
VARIOUS ECONOMIC PLANTS
PARA RUBBER
PARA RUBBER
BANANAS
BANANAS
Hill side
Swamp
WEST INDIAN MANGOES
Garden House
Servants' Quarters
ORNAMENTAL BEDS
ORANGES AND VARIOUS FLOWERING SHRUBS ETC.
PINE APPLES, NATIVE TREE RUBBER ETC
WEST INDIAN MANGOES
Fence with creepers
Kitchen
Fence
Office Store
Shed
CACAO
WEST INDIAN MANGOES
TRINIDAD MANGOES
VARIOUS ECONOMIC PLANTS
VARIOUS ECONOMIC PLANTS
ORNAMENTAL & PROPAGATING BEDS
FLAMBOYANTE IN CENTRE OF GRASS PLOT
CASHEW-NUT, LANDOLPHIAS ETC
NATIVE TREE RUBBER, TEAK ETC
ORANGES AND VARIOUS ECONOMIC PLANTS
To Duke Town
To Bridge
To Barracks
VARIOUS ECONOMIC PLANTS
VARIOUS ECONOMIC PLANTS
ORNAMENTAL BEDS
VARIOUS ECONOMIC PLANTS
VARIOUS ECONOMIC PLANTS
KOLA AND MANGOES, CHIEFLY
KOLA AND MANGOES, CHIEFLY
KOLA AND MANGOES, CHIEFLY
NURSERY BEDS
PINE-APPLES
VEGETABLE GARDEN
VEGETABLE GARDEN
Gate
W
F
N
C
H
F

To face page 29.

Printed at the Ordnance Survey Office Southampton 1908

OLD CALABAR.

The Botanic Garden at Old Calabar was formed in 1893. Mr. Horace Walter Leighton Billington was appointed the first Curator, and when he arrived on the 20th March, 1893, the site was covered with dense bush which it took 30 Calabar labourers two months to clear.

The establishment, like that of Lagos, began well under the auspices of a favourable administration, Sir Claude MacDonald, the Consul-General, having founded it "to the end that every encouragement be given to the cultivation and collection of various natural products." By his instructions Mr. Billington drew up a very useful little pamphlet on the cultivation of coffee and cocoa, which was translated into Efik—the native language of Old Calabar—for free distribution to the neighbouring Chiefs. This pamphlet, somewhat extended in scope, was revised and reprinted in English during 1896, and according to Mr. Billington's report (1896-97) many applications for copies had been made by the natives. A list of plants growing in the Gardens had also been completed, and he considered the state of the Gardens as generally satisfactory, and that their object was being fulfilled.

The list referred to enumerated about 259 different species, the more important of which will be dealt with botanically in their respective positions.

The writer, on the recommendation of the Director of the Royal Gardens, Kew, was appointed Assistant Curator of the Garden in 1896, and arrived in the Protectorate in June of that year. Mr. Billington, unhappily, died in November, 1897, very shortly after his return from the usual leave in England.

In January, 1898, the writer, then in England on leave, was appointed by the Secretary of State for Foreign Affairs Curator in succession to Mr. Billington.

From November, 1897, to March 2nd, 1898, the date of the Curator's return from leave of absence, the Garden was consecutively under the care of Dr. Allman, P.M.O., Mr. G. H. Bailey, Assistant District Commissioner, and Dr. Fenton, D.M.O.

The permanent staff at the time consisted of two overseers and 25 labourers. The area under cultivation was approximately 50 acres. To this was added the care of the plants on Government Hill, including a large orchard, covering another 50 acres or so, but prison labour was allowed for cutting grass and cleaning generally in this portion.

Up to this period no definite policy had been formulated, although the Department in its relations to the Protectorate had perhaps done its duty. With the object of placing the work on a recognized basis, the following scheme was approved by the then Acting Consul-General (Lieut.-Col. H. L. Gallwey).

Scheme for the Organization of the Botanical Department.

"Section I.—Agriculture: To introduce and cultivate plants from other Tropical Countries, giving particular attention to those that are likely to be of value commercially or for consumption in the Protectorate.

To devote attention to improving and extending the cultivation of the most useful known plants, already existing in the country, whether for food or for manufactural purposes.

Section II.—Botany and Horticulture : To form and maintain, in as interesting and as systematic a manner as possible, a named collection of Economic and Ornamental plants, both Native and Exotic.

Section III.—Nursery : To propagate Economic and Ornamental plants for sale or free distribution, giving preference to those of Economic value.

Section IV.—Vegetable Garden : To cultivate experimentally such vegetables that are likely to adapt themselves to the climate.

Miscellaneous.—To prepare Circulars on Soils, Cultivation of Plants, or any subject estimated to be of service in improving the condition of Agriculture or Horticulture in the Protectorate.

To correspond with Planters, or anyone in the Protectorate who may be interested in the cultivation of plants, or in the development of new cultural industries.

To correspond with other Botanic Gardens, with a view to exchanging plants and seeds.

To investigate the diseases and insects destructive to cultivated plants.

To organize Agri-Horticultural Shows.

To collect indigenous plants, for the purpose of obtaining the names of those that are unknown, and preserving them for future reference.

To obtain reports on the value and utility of new or little-known products.

To pay occasional visits to the Native Farms for the purpose of affording practical instruction in planting, pruning, tillage of the soil, &c.

To train Native boys in Agricultural and Botanical work generally, with a view to fitting them eventually for positions of trust in other parts of the Protectorate.

To plant and maintain somewhat after the manner of a Park, Consulate Hill ; responsibility to extend no further than what is required for the proper treatment of the plants and trees alone, which exist outside Private Gardens."

It will be understood that such a scheme could not be followed with mathematical accuracy, but given men, means, and time, it ought to form the basis of all the necessary operations and to meet all the requirements of the country and its people in the direction indicated.

In May, 1898, Mr. Harold Buchan Lloyd was appointed Assistant Curator by the Secretary of State for Foreign Affairs on the recommendation of Kew. He arrived at the Gardens in June, but unfortunately after little more than a year's service he was permanently invalided.

In August, 1897, arrangements had been made with the Principal of the Hope Waddell Institute at Old Calabar to train some of the boys in agricultural work. To commence with, four boys were given a trial; two shortly afterwards resigned, and the two remaining (Oghomaru and Ekoke) came regularly each morning to the Gardens, and continued their studies at the Institute during the afternoon and evening of each day.

They continued to give satisfaction, and after about 2½ years' training a small allowance was given them from the labour vote. They were still connected with the Mission Institute, and in view of the fact that they would soon be completing their studies there it was desirable to have something definite arranged as to their future. Nothing, however, was done during the writer's term of office, and no details are available as to what has been done since, except that Oghomaru, the elder of the two, was made a Native Court clerk. They were both earnest and trustworthy and likely to do the Institute credit as an educational establishment.

In October, 1900, the Curator went on leave, and as no successor to Mr. Lloyd had been appointed, the Department was again handed over to the care of the Principal Medical Officer, Dr. Allman, who had always taken special interest in the work.

On the retirement of the writer from the service of the Protectorate in 1901, on appointment to an Assistantship (Museums) Royal Botanic Gardens, Kew, no Curator was appointed until a change occurred in the Administration, the place in the meantime being maintained "on the grounds of sanitation and health."

In 1905 the Governor (Sir Walter Egerton) reports* "The Botanical Gardens, Calabar, have been sadly neglected in the past for the want of a properly qualified Curator.

"Mr. Don,† however, from the Gold Coast was appointed Curator towards the end of the year (1905), and it is to be hoped that great developments will now follow and make them really useful for the cultivation and distribution of important Economic plants."

A considerable extension to the Gardens has recently been made, and has been planted with various Rubber-producing trees.‡

The Department is now (since June 1905) incorporated with that of the Forestry.

AGRICULTURE.

The general principle of Agriculture in Nigeria is "extensive," that is to say the Native cultivates as much ground as he thinks will bring in a sufficient quantity of Yams, Cassava, &c., without any more labour or trouble than simply cleaning and working the soil. If a larger crop is wanted he cultivates more ground, and when one piece of ground is exhausted, he clears more bush and starts afresh on another piece.

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* Col. Rep., Ann., No. 512, 1906, for 1905, p. 26.

† Curator of the Tarkwa branch of the Bot. and Agri. Dept., Aburi.

‡ Col. Rep., Ann., No 554, 1908, for 1906, p. 41, and Rep. on the Botanical Gardens for Quarter ended June 30th, 1907. Suppl. to Gazette No. 45 of Aug. 28th, 1907.

There is but little restriction as to space for the Native Chiefs and their people in Nigeria, and in some ways this is unfortunate and bad for the country in general.

It has been stated by Mr. Punch,* with regard to Lagos, that, "The accepted doctrine that private ownership of land is against African Custom is a disadvantage.

"The farmer does not look on the land as permanently his property, to be improved and developed, but crops it without rest or rotation until absolutely exhausted, and then sacrifices more forest.

"I think it would be good if forest land were vested in the acknowledged native authorities, that farmers were encouraged to register their farms, and that burning of new forest were utterly prohibited.

"That quite sufficient forest land has been cleared for the agricultural needs of the people is proved by the enormous tracts of Isale † bush, showing the position of abandoned farms."

The boundaries of the native plantations should be settled in the first instance officially by Europeans, and as the soil, however good it may be at the start, will eventually become poor and ineffective, the "intensive" method of cultivation shculd be adopted instead of clearing another area, and work should be conducted on scientific principles towards the improvement of the soil by manuring and effective tillage.

The simple requirements of the native cultivator, or at least all that has been so far aspired to, are a matchet, a pointed stick, a box of matches, and a hoe ; these are his capital, and of the other agents of production, land, with the natural adjuncts of heat and moisture, are freely and fully supplied, and labour is to be had in sufficiency, either individually or at the command of the Native Chiefs.

No accurate measure of the fertility of the soil under these conditions can be given, but its producing powers are remarkable. The soil usually is not worked to any depth greater than that of the hoe-blade, 6 to 9 inches or a foot at the most, and manure is never used. There are extensive areas under cultivation in the Old Calabar and Cross river districts, particularly inland from Ogurude.

With reference to the country lying between Zaria and Kano, Sir Frederick Lugard‡ has mentioned that "the method of cultivation is more thorough and more advanced than is usual in Africa. The soil is worked to a depth of over a foot, and here and there rude forms of irrigation are employed, while for the first time in Africa I saw with surprise that the fields are manured."

Lieut.-Col. Mockler-Ferryman§ describes the Agriculture of the province of Kano as follows.

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* Rep. February 9, 1899, Botanical Enterprise in W. Africa, 1889–1901, p. 98.

† Native term for abandoned farm land, "Igboro" is twice-grown scrub.

‡ Geog. Journ., Vol. xxiii., 1904, p. 22, Northern Nigeria.

§ "British Nigeria" (1902), p. 170.

"In the neighbourhood of the capital and for a distance of even eighty to a hundred miles in all directions, is a perfect garden, and nothing strikes the traveller to Kano so much as this vast expanse of cultivation. Whether he approaches the great city from the north, south, east, or west, the same sight greets him; hitherto he has seen nothing like it in Africa, for the most fertile lands in other parts are mere patches of cultivation compared with the province of Kano. Acres of Guinea corn are succeeded by acres of Indian corn, wheat, rice, or other cereals; then follows a stretch of cotton and millet, the two sown together in alternate rows, so that the latter may protect the former when young from the fierce rays of the sun; here is a field of indigo, there a plantation of cassava (manioc) or of ground nuts; while beyond again is a veritable kitchen garden, well stocked with peas, beans, bananas, sweet potatoes, onions, and every variety of vegetable and herb. All these crops are produced with little actual labour beyond sowing and reaping. The hoe is the only agricultural implement, and the soil is hardly turned, and never dressed, the rest being left to nature. Valuable trees also stand scattered among the cornfields, and from them the farmer obtains, simply for the gathering, many saleable articles. Such are the shea-butter tree, the locust, the gambier, the tamarind, the baobab, and a species of plum tree. Silkworms feed on the tamarind leaves, and bees in great quantities nest in the trees near the villages, being carefully preserved for the sake of their honey and wax; while the pastoral tribes possess large herds and flocks."

Mr. (now Sir William) Wallace,* in describing the Sokoto Empire and Borgu, states that "most of the land is under cultivation with the exception of perhaps a fourth lying fallow in its turn. Much of the ground in the neighbourhood of the towns is divided into fields by raised earth-work dykes, or hedges mostly of cactus."

"After the first rain they sow corn. The ground is not cleared, indeed it hardly requires it, for undergrowth there is none, and with the exception of such stumps of last year's crops as have not been pulled up and used for fuel the ground is as bare as the palm of one's hand. I did expect, however, that the soil would in some manner get a turnover, but even this was not usually necessary, the old furrows being used again and again. The corn is sown on the top of them in the spaces between last year's stumps, which are on an average about 3 ft. apart, while the width of the furrows is generally about the same; but this distance varies from 1 to 4 ft., according to the richness or poverty of the soil. The furrows are barred across with earth every 20 to 40 ft., to retain the rain, so that after a heavy shower the whole country appears as if covered with innumerable little reservoirs. One labourer walks with a light hoe, with which he lifts small clods out at the regulation distance. The sower follows him and drops six to twelve grains of the cereal into each hole, pressing back the clod on top of the grain with his foot. The grain ripens in from four to seven months, according to the variety, the Guinea grain taking the longest; during this time the ground requires cleaning three or four times. All the population are farmers, with the exception of a few people in the larger towns. The principal crops raised are Guinea corn, Indian corn, a small cereal called gero, wheat, cassava, rice, onions, cotton, indigo, peas and beans of various sorts, sweet potato, ground-nuts, and various kitchen vegetables and herbs. The Guinea corn is most prolific, a good head yielding from 3,000 to 4,000 grains."

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* Geog. Journ., Vol. viii., 1896, p. 212.

The first efforts by Europeans to improve the condition of agriculture in Nigeria were made in 1841, when a Model Farm was started near the confluence of the Niger and the Chadda (Benue) under the protection of the Admiralty Expedition sent out in that year. The ground (some 300 acres) formed part of a territory of 100 square miles purchased on behalf of Her Majesty's Government for seven hundred thousand cowries or nearly £45; one-fifth of this amount was paid on the signature of the Deed of Transfer, and the remainder was to be paid, if the Government were desirous of retaining the land, after twelve months. Payment was to be completed in one or five instalments as might be most convenient to the Queen of Great Britain. The Commissioners for the purchase were the Officers commanding the Expedition, Capt. H. D. Trotter, R.N., and Capt. William Allen, R.N., and the amount referred to was paid to the Attah of Eggarah.

Dr. Vogel (Botanist) and Dr. Stanger (Geologist) selected the site. They had been sent out with the Expedition in question by the African Civilization Society, to whom the land for the Model Farm was granted on a rental of one penny per acre, and payment was to be paid into Her Majesty's Treasury by the Model Farm Society, of Mincing Lane, London (an auxiliary of the A.C.S.), who controlled the farm. The Superintendent was a West Indian, Mr. Alfred Carr, and the Admiralty had granted him a passage with the Expedition.

All the efforts, however, to establish the farm ended disastrously, for in less than a year after the commencement it was considered advisable to abandon the settlement, and discretionary power in the matter was given by Capt. Allen, the Senior Commissioner, to Lieut. Webb, of the "Wilberforce,"* after Her Majesty's Government had declared the Niger Expedition at an end.

At the time of Lieut. Webb's visit (July, 1842) it was found that the most complete disorganisation amongst the workmen had taken place, and it was believed that there was "no prospect of matters amending without some European of ability and firmness to direct the affairs."

Mr. Carr had been compelled to leave his post for a time owing to severe illness. He never returned, and his fate could never be rightly ascertained but it was presumed on good authority that he was murdered when on the way back to his post.

The operations were clearly of a limited nature, for it is stated† that "at the time of giving up the model farm there were about twenty acres of land under cultivation and in good order, chiefly planted with cotton and a few yams. The first cropping with corn and cotton had entirely failed, due it was supposed to the seed having got damaged on the voyage from England. The crops then growing were the produce of country seed and were very promising."

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* Lieut. Webb's authority was conveyed in a letter written by Capt. Allen, of the "Wilberforce," at Clarence Cove, Fernando Po, June 29th, 1842 (*see* "A Narrative of the Expedition sent by Her Majesty's Government to the Niger, 1841," Allen and Thomson).

† "A Narrative of the Expedition to the Niger, 1841," Allen and Thomson.

In 1888 the Royal Niger Company, whose trading operations extended as far inland as Gando and Sokoto, began some cultural work at Asaba. In their Annual Report for the year ending 31st December, 1888, it is recorded that "with the valuable assistance of Mr. Thiselton-Dyer, Director of the Royal Gardens at Kew, the Council have established a public botanical plantation on a small scale at Asaba, where experiments in the commercial botany of the territories are conducted, and from which it is intended that suitable plants and seeds may shortly be supplied at a moderate price to native and European cultivators and settlers. "They have also established in the neighbourhood of Abutshi a second experimental Administrative plantation for the growth of coffee and cocoa, for the purpose of similar distribution to all who may desire to cultivate those products." *

In January, 1889, the Company applied to Kew for a man to take charge of the botanical work on Plantation No. 1 at Asaba, and Mr. George Woodruff was appointed.

In July, 1889, a second man was applied for from Kew, and Mr. Harold Edmund Bartlett was appointed with the special charge of No. 2 Plantation at Abutshi. Plantation No. 1 at Asaba did not prove satisfactory owing to the too great dryness and lightness of the soil, and Mr. Woodruff was transferred about the end of September, 1889, to a plantation with richer soil in the immediate vicinity of the one at Abutshi.

On the 16th March, 1890, Bartlett† wrote to a friend at Kew :— "I have got about 1,000 acres of land which has to be all opened up and planted. The name of the plantation is the Nkissi Creek Plantation, so named after the Nkissi river which runs through it.

"About 20,000 coffee and cocoa plants and 130 pods of cocoa seed arrived three days ago from Lagos as a first instalment for a plantation. The plants I took out are doing very well. The coffee plants at Abutshi are very promising, cocoa and cotton likewise show up well. Woodruff is planting Sansevieria hemp now."

Two months later (May 16th, 1890) Mr. Bartlett died of hæmaturic (Blackwater) fever.

On the 20th May, 1890, Woodruff,‡ writing to a friend at Kew, mentioned that his plantation was about 8½ acres, and that he hoped by the end of that year to have it all planted ; but a few months later (on the 2nd January, 1891) Mr. Woodruff also died of Blackwater fever.

The early and sudden decease of these two officers was much to be regretted. It is recorded that the Company did everything in

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* Kew Bulletin, 1891, pp. 86–87.
† Kew Bulletin, 1891, p. 90.
‡ Kew Bulletin, 1891, p. 93, where Woodruff's letter is given in full.

its power to promote their health and comfort. In the Kew Bulletin for 1891,* where this untoward result is chronicled in greater detail, it is stated that "it seems only just to place some account of the work in which they perished on record. If Kew sent them to Africa, where they met their death in the attempt to do something to extend the resources of the Empire, it may at least rescue their names and memory from complete oblivion."

These plantations were eventually transferred to the Government of Southern Nigeria. The High Commissioner (Sir Ralph Moor), after an inspection on the Niger in December, 1900 and January, 1901, was sanguine that with proper management these plantations, which were taken over at considerable expense, could be made at least to pay their way and considered that some small initial outlay to make the attempt was advisable. An Assistant District Commissioner in the service of the Protectorate, of considerable experience in work of this nature, who had assisted in preparing the estimates was recommended to take charge of the plantations and to become manager in subsequent years should the success warrant such expenditure. For the first year 10 per cent. on the gross returns was to be allowed as an inducement to the officer to do all in his power to make the plantations a success. The course proposed was sanctioned by the Secretary of State.

The Acting High Commissioner's (Lieut.-Col. H. L. Gallwey) report for 1900† gives the position for that year.

It was reported that the plantations of the Royal Niger Company on the Niger had been taken over by the Protectorate during the year, and the number of trees at each place was given as follows :—

Name of Plantation.	Plants.	Permanent Places.	In Beds.
Abutshi	Liberian Coffee ...	11,863	4,989
"	Cocoa	612	40
Nikissi	Liberian Coffee ...	72,690	—
"	Arabian Coffee ...	140	380
"	Rio Pongo Coffee	1,200	—
"	Cocoa	30	—
Akpakka	Liberian Coffee ...	16,200	3,610
"	Arabian Coffee ...	400	—
"	Cocoa	364	600
The Creek	Liberian Coffee ...	15,030	13,350

At the Onitsha Station extensive developments were in progress under the supervision of a European officer of practical experience. The necessary machinery had been arranged for and satisfactory progress generally had been made. Coffee was sold and exported to England in small quantities and a satisfactory increase in this respect was looked for under the efficient supervision then given to it.‡

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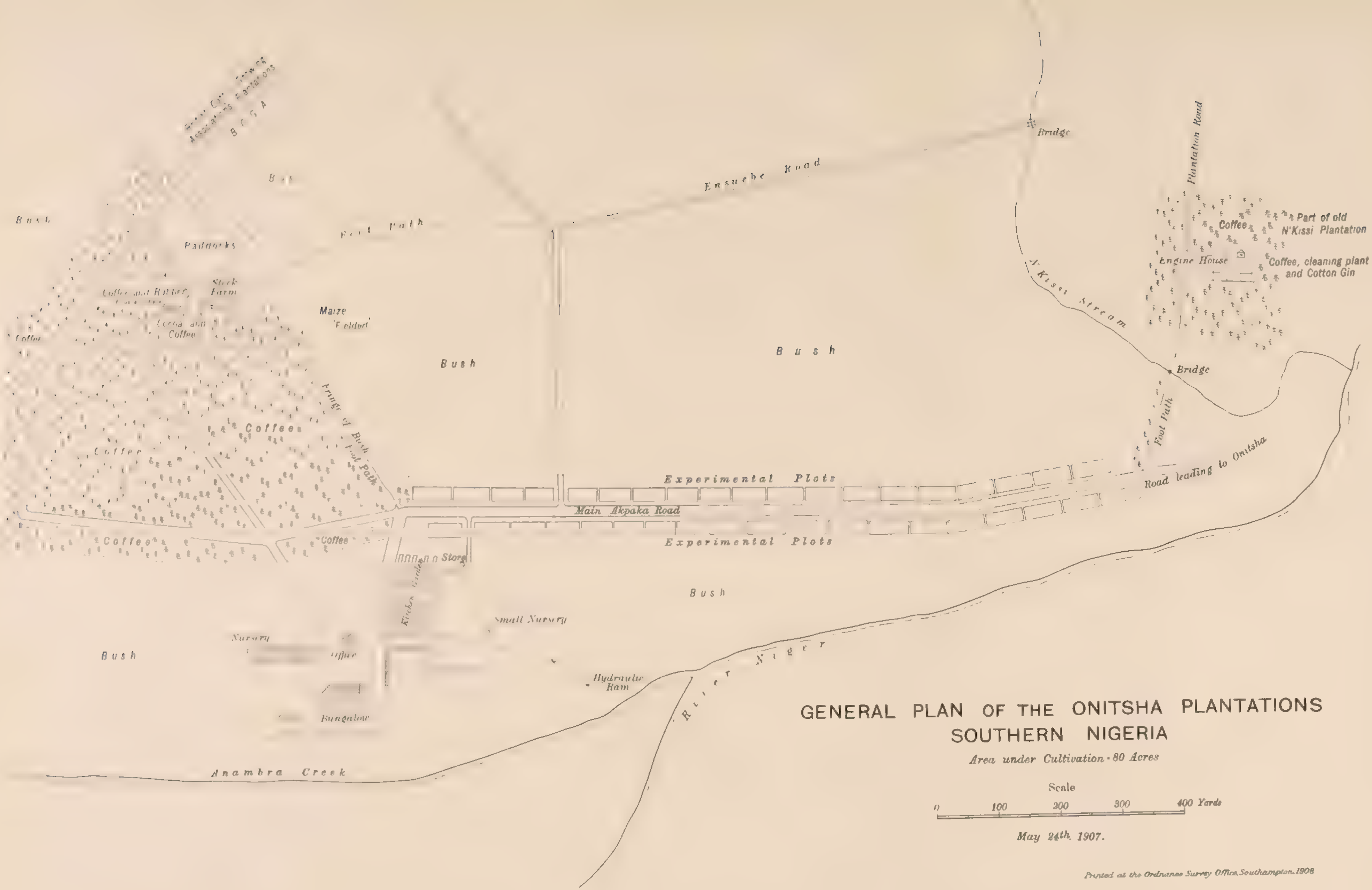
* Kew Bulletin, 1891, p. 86.

† Col. Rep., Ann., No. 353, 1901, for 1900, p. 13, S. Nigeria.

‡ Col. Rep., Ann., No. 381, 1902, for 1901, S. Nigeria.


Association's Plantations
B C G A
Bush
Bush
Paddocks
Foot Path
Ensuebe Road
Bridge
Plantation Road
Part of old N'Kissi Plantation
Coffee
Engine House
Coffee, cleaning plant and Cotton Gin
N'Kissi Stream
Bridge
Foot Path
Coffee and Rubber
Stock Farm
Maize 'Folded'
Cocoa and Coffee
Coffee
Bush
Bush
Fringe of Bush Foot Path
Coffee
Coffee
Experimental Plots
Main Akpaka Road
Experimental Plots
Road leading to Onitsha
Coffee
Coffee
Store
Kitchen Garden
Bush
Small Nursery
Nursery
Office
Bush
Bungalow
Hydraulic Ram
River Niger
Anambra Creek
Scale
0
100
200
300
400 Yards

GENERAL PLAN OF THE ONITSHA PLANTATIONS
SOUTHERN NIGERIA

Area under Cultivation - 80 Acres

May 24th. 1907.

Printed at the Ordnance Survey Office Southampton. 1908

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The ultimate result, however, of all these praiseworthy efforts to make the plantations at Onitsha pay evidently did not succeed to the extent anticipated, as will be shown in the course of the following record* :—

"The total area of the Onitsha plantation is 450 acres (1904). The bulk of this is planted with coffee, only a few acres being devoted to cocoa."

"The total expenditure for the three years 1901–2, 1902–3, and 1903–4 was £3,258, while for the same period the revenue was approximately £1,260, showing a loss on working of £1,998, or calculated on an average for the period there was an annual recurrent expenditure of £900, with an annual loss of about £400."

"In considering the value of this plantation it would be unsound to pass judgment on the 'will-it-pay' principle, for experience gained as to the unsuitability of specific products to local climate and soil conditions may form a good investment, although the actual financial results may at first sight seem disappointing. It has, however, been deemed prudent to carry out experiments on a somewhat restricted scale and to put the plantation in charge of the Forestry Department."

"With the abandonment of the coffee plantation the work of experimental cultivation will not however cease. Arrangements have been made and ground prepared for carrying out a comprehensive series of experiments."

"Plots of ground will be sown with native cotton, with and without manure, with ground-nuts alone, and with native corn. Various native beans, indigenous and exotic, tobacco, tea, and indigo will also be subjects of experiment."

During 1905 we are told† that the Onitsha plantations yielded 38,100 lbs. of coffee, of which 20,180 lbs. were cleaned and ready for shipment at the end of the year; that the cultivation of cocoa had not been a success, owing to the unsuitability of the soil; that the planting of *Hevea brasiliensis*, *Ficus elastica*, and *Funtumia elastica* was commenced, but the latter proved a failure, probably owing to the unsuitability of climate,—the other two species were doing well; that cotton was a complete failure; that castor oil, Virginia tobacco, and several kinds of English vegetables and flowers had been grown successfully, and that coffee plants (1,400), cocoa (400), and fruit trees (40) were distributed from the nurseries.

Following on the formation of the plantations at Onitsha came in 1899, the establishment of the Model Farm at Ibadan, under the superintendence of Mr. Cyril Punch. Its main object was primarily the propagation of rubber trees, but it was hoped that it would be possible to introduce the plough, drawn by oxen, to raise better breeds of animals, and generally to improve the methods of agriculture. The Governor of Lagos (Sir William MacGregor) describes* (November 17th, 1899) this Model Farm as follows: "The headquarters are on a suitable site, a low ridge about a fourth of a mile from the creek Ono, and a little more than four miles from the Ibadan road. The farm lands march with the Ibadan Forest Reserve on one side. They are sufficiently extensive, embracing about 4,000 acres. The soil is of a fair quality and is evidently the home of the rubber tree. There is generally about a foot of humus, merging into brownish clay or into fine gravel at a depth of two or three feet. It is slightly undulating and all covered by forest. It is fairly well watered for this country. Mr. Punch has established a nursery of three acres, very well situated on the creek, in which are set out some 10,000 plants, of which 8,000 are the Ire rubber, enough to plant 40 acres of forest when the planting season, May and June, arrives."

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* Col. Rep., Ann., No. 459, 1904, S. Nigeria. *See also* Rep. on Govt. Plantations at Onitsha, in S. Nigeria Govt. Gaz., No. 22, July 21st, 1905, pp. 388–393.

† Col. Rep., Ann., No. 512, 1906, p. 25.

In 1902 another Model Farm was founded at Oloke-Meji, about 93 miles inland to the north of Lagos, and at this place, as already mentioned, the principal operations of the Botanical Department were centred.

By 1903 Agriculture appeared to be making good progress, and in that year a new Director of Agriculture (and Forests), Mr. J. H. J. Farquhar, B.Sc. was appointed.

In November, 1903, the Governor (Sir William MacGregor) was in a position to advise the Secretary of State of the formation of an Agricultural Union, with a central council in Lagos, and to request sanction to a vote of £250 for the following year for the purposes of the Agricultural board. The "objects" were stated to be, the introduction and distribution of new and improved seeds, plants, implements and domestic animals, to give assistance by means of experimental farms and gardens; the encouragement and development of agriculture by teaching, promoting shows, and by any means at command. Experiments instituted by the Board would be carried out at the Model Farm at Oloke-Meji, and farmers and others could join the Union without paying any subscription.

This movement was one of the outcomes of the Agricultural Show held at Lagos on the 11th and 12th of November, 1903; the first of its kind ever held in the Colony or indeed in West Africa. The show was opened by the Governor, who, in the course of his speech, pointed out that the producers of the country are the natives of the land and that the main object of the Show was to facilitate and increase the products they raise from the soil, since it was on the soil that the future of the land depended.

It is recorded that 20,000 people at least, including many of the Native Chiefs, attended this show on each of the two days.

At the present time planting operations under European supervision, other than those undertaken by the Government, are not extensive. The African Association have had plantations established for several years at Adiabo (Calabar river), Eket (Qwo Obo river) and recently in the Central province of Southern Nigeria. Messrs. Alex. Miller Bros. & Co. have taken up the cultivation of Para rubber on a plantation at Sapele, Central province, Southern Nigeria. The British Cotton Growing Association have land under cultivation in various parts of the two Colonies.

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* Botanical Enterprise in West Africa, 1899–1901, No. 132, p. 162, Sir William MacGregor, Lagos, No. 17, 1899, to Mr. Chamberlain.

It is recorded that (1898) the Ilaro Plantations, Ltd., had over 300 acres cleared and planted up with coffee, then 3 to 4 years old.*

The Oil Rivers Company have † a plantation well established of coffee and cocoa at Buguma in the New Calabar district.

Mr. Elliott reported (1907) ‡ that there were no planting operations of a private nature in Northern Nigeria with the exception of the work of the British Cotton Growing Association's Model Farm near Lokoja.

FORESTRY.

SOUTHERN NIGERIA.—The first mention of Forest Conservancy in Nigeria appears to have originated with Sir George Denton, § in 1897, when Acting Governor of Lagos, in a letter to the Colonial Office. The subject was suggested owing to the effects of the destructive methods of tapping rubber trees, then beginning to make themselves apparent. He wrote as follows: "I think myself that a Forest Department established on somewhat similar lines to that in India, but of course limited in its dimensions, is an urgent need, and I would recommend that the Director of the Royal Gardens, Kew, be consulted on the subject. Both Mr. Thiselton-Dyer and Dr. Morris have given us valuable assistance in the past and take a great interest in Lagos, and I feel sure that they will do their best to suggest to us a practical way out of the difficulty."

In his reply to the Colonial Office on the subject the Director of the Royal Gardens, Kew,‖ remarked: "How far any system of forest conservation can be applied to the rubber-yielding districts is a matter on which it is difficult to express an opinion. To carry out the measures of a Forest Department, a system of forest guards is necessary and this requires a revenue. Whether the administration of the rubber-producing area has reached a stage of development sufficiently advanced to admit of this is a matter for the Local Government to consider. But that the question is one of the greatest importance for the future prosperity of our West African Possessions there can be no doubt."

The recommendations of Captain Denton as to the necessity of a Forest Department were endorsed by the Governor (Sir

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[*] Sir George Denton (Acting Governor), Lagos, Dec. 19th, 1898, to Mr. Chamberlain. Botanical Enterprise in West Africa, 1889-1901, p 81.

[†] This was so, at least, in Sept., 1898, when it was visited by the writer.

[‡] Kew Bulletin, 1907, p. 249.

[§] Botanical Enterprise in West Africa, 1889-1901, p. 30.

[‖] l.c., p. 32.

Henry McCallum), who went further, and preferred "that it should be an Economic Department, whose duty would be not only to protect existing forests, and reafforestate denuded districts, but also to develop new experimental agricultural industries, so that the prosperity of the Colony should not be entirely dependent on the price of and demand for palm oil and palm kernels."

Following on these recommendations Mr. Cyril Punch was appointed on the approval of the Secretary of State for the Colonies, Inspector of Forests (October, 1897).

The first Bill to provide for the establishment and regulation of the Forestry Department and for the proper regulation of the forests of the Colony was drafted in 1897. It was introduced to the Local Legislative Council on November 3rd, 1897, and passed the second reading on November 11th, without any serious criticism. It was, however, objected to so strongly by a large number of the native community, who appeared to regard it as interfering too much with their rights of land tenure, that its Proclamation was deferred, and finally the Secretary of State considered it should be withdrawn and legislation on the subject deferred until a Land Ordinance had been passed defining the rights of native chiefs in regard to land, including the forests.

The first Forest Reserve was constituted at Ibadan in August, 1899.

This reserve had for its object the preservation of timber and the improvement of the rubber yield. A set of Rules were passed by the Ibadan Council, and although some forestry rules made by the native authorities had been drawn up in December, 1898, for the protection of rubber and timber, the Regulations [*] made in connection with the Ibadan Forest Reserve appear to have been the first real and successful attempt at forest conservation.

These rules came into force on the 1st of October, 1899. The area set apart was bounded on the north and west by the Odo Ona river; on the east by the Ibadan-Mamu road; on the south by Jebu territory, covering in all about 100 square miles.

A Deed of Gift was signed by eleven of the influential Chiefs of Ibadan on the 8th day of October, 1899, ceding the Mamu Forest Reserve,[†] as a token of friendship and goodwill towards the Government of Her Majesty the Queen of Great Britain and Ireland.

Then followed the lease by the Alake of Abeokuta and authorities of the Egba nation for 99 years, of the Oloke-Meji Forest Reserve[‡]; the first quarterly payment (annual sum £25) being made on the 25th December, 1900.

Next came the formation of the Oshun river Forest Reserve [§] about 100 square miles in extent granted 22nd January, 1904, by the

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[*] See Govt. Gaz., S. Nigeria, Vol. 2, No. 63, Nov. 20th, 1907, p. 2239, for a copy of the Regulations.

[†] Copy in Govt. Gaz., No. 63, Vol. 2, Nov. 20th, 1907, p. 2238.

[‡] Copy of Indenture, l.c., p. 2246.

[§] Copy of Agreement, l.c., p. 2244.

Awujale and Chiefs of Jebu-Ode to the Government in perpetuity. A temporary agreement for this Reserve had been made 3rd December, 1900. The situation was regarded as excellent ; the forest fine, and of mature age.

The Ilaro Forest Reserve* in the Badagry district was granted 26th April, 1904, for a term of fifty years subject to renewal rom time to time. A Deed of Grant for this land had been made on the 11th June, 1901, but owing to some misunderstanding of the covenants as to tribal ownership, this was cacelled and the new indenture drawn up accordingly.

he condition of these Reserves in 1905 may be gathered fro the following extract from a Colonial Office Report† :—

"During the year frequent visits were made to all the Governmen reserved forests, their boundaries were inspected, roads cleard and new ones made, farming and hunting registers checkd, and the planting in them of economic plants, such as Para ubber, *Funtumia elastica*, Iroko (*Chlorophora excelsa*), mahogny, &c., undertaken systematically. In this respect the Mamu nd Oloke-Meji reserves are more advanced than the others. The foner have been divided up into compartments that are cleared undergrowth, the large trees being left as standards, and a ctain number planted every year with the indigenous rubber tr, *Funtumia elastica*. Up to date, seven compartments, amountingo 150 acres, have been completely stocked with that species wht clearing operations were carried out during the year for further anting in 1906. The Oloke-Meji reserve, owing to its proximity t the railway, is the most valuable one we possess. The forests re mainly of the 'deciduous' type, but 'mixed' ones are also be found along the banks of the Ogun river and on the shady pects of the hills. Valuable species, such as the West African ahoganies and cedars, are to be met with here. A certain amou of restriction has been placed on farming, and the natives werduced to plant up the fallow land with rubber, Iroko, and othevaluable plants. The Oshun river reserve is much cut up w farming and, owing to its inaccessibility, difficult to manag The planting of the indigenous rubber tree was started here dng the year.

" In the Illaro rese group regeneration under the wild rubber trees was begun, ance planting of six acres with that species accomplished, whilst re land was prepared for planting during 1906. Besides these ur reserves, which are either leased to Government or belong it outright (Mamu reserve), the Department has, conjointly wi the Ibadan authorities, the management of the Ibadan State reser This was adequately protected during the year."

" The forests in the Iles and Ondo districts are regarded by the Conservator as being tchest in the whole of the Western province."

Reservation in Southern N ia, outside Lagos, was (1905) also being kept in view. Accordi the Colonial Secretary's Report ‡ for that year “there is one Reserve in the Protectorate, situated on the Alabetta river, which is exploited to feed the Government saw mills at Onitsha, on the river Niger. Other areas have, during the past year, been selected for reservation. In the Benin district the native Chiefs and Councils have agreed to reserve the forests for 1,000 yards along both banks of every river, and for 100 yards on each side of every main road. This is a very decided step in the right direction, as the indiscriminate destruction of the forest for farming if allowed to continue unchecked, would resut in irreparable loss.”[*]

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* Copy of Indenture, l.c., 41.

† Col. Rep., Ann., No. 507, for 1905, S. Nigeria, p. 24.

‡ Col. Rep., Ann., No. 512, 1. Nigeria, p. 24.

Following this process of Reservation, which prepared he way somewhat for the more comprehensive system of Conseva-tion, the following extracts from official correspondence and her sources, mark the beginning and general progress of the prsent Forestry Department of Southern Nigeria, the inceptio of which may be fairly accredited to the energy and foresiht of Sir Ralph Moor, when High Commissioner. The Director Kew (Sir W. T. Thiselton-Dyer), writing February 21st, 1900,[†] to the Colonial Office on the subject of Forestry in West Afri stated that:—

“These territories can never, properly speaking, be olonised. Nor will they, in all probability, afford much scope r British planting enterprise, at least not until the higher leels of the interior have been made accessible by railways. the same time peace and order have to be maintained ; a reveue must be obtained and trade developed in order to meet the xpense, and the moral development of the population must encouraged. The methods of Indian administration seem to ord the only parallel.

“Those methods involve a much more energe action on the part of the Government than is usual or perh desirable in a colony properly so-called. This is especially th case in regard to forest conservation. The immediate effect o pening up these African territories has been to rapidly exha the resources of their accessible forests. At first I was under e impression that these were so considerable that the risk of e ustion was of little moment compared with the indirect benefi om an export trade. But it is now evident that this is not so, d that an important natural asset is being rapidly used up. o use the Governor’s words, the ultimate result will be for th and to become naked, and to possess only its bare agricultural sources.

“It scarcely requires argument to ew that such a state of things is eminently undesirable, and uld not be creditable to British administration. I gather fro previous papers, and from conversation with Mr. Punch, that i s been hoped that it might be obviated by utilising the au rity of the native chiefs. Mr. Punch, who seems to me to ve a very clear insight into the merits and defects of the na character, is quite clear that nothing is to be expected in this ection.

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[*] Reserves have now (1908) been r in the Oban and Idah districts. Govt. Gaz., S. Nigeria, Nos. 31 & 56, 1908.

[†] Botanical Enterprise in W. Afr 899-1901, p. 180.

"It appears to me that, sooner or later, the Secretary of State will have to adopt the Indian system of Forest Conservation. Experience has shown that this system not merely preserves the resources of the forests, but also yields a very important revenue.

"This system involves the expropriation by the Government of the land of reserved forests. Mr. Punch pointed out to me that this might meet with some protest from the natives. He appeared, however, to think that the difficulty was rather theoretical than real. In any case it has been overcome in India, the people of which have cheerfully acquiesced in the result.

"The work which Mr. Punch is carrying on, under the direction of Sir William MacGregor, appears to me in every respect excellent, but it is clear he is dealing with practically exhausted forest, and the process is necessarily somewhat expensive. The fundamental principle of efficient forest management is to draw from a forest an annual crop which represents its natural increment, and never diminishes its capital value. Experience in India shows that this can be done, but the appropriate methods vary in different cases, and it requires a skilled expert to work them out locally.

"I am of opinion, therefore, that the time has come when the vast territories under British rule in West Africa require the services of two or three experienced forest officers, who should be drawn from the Indian Forest Service. Probably the time is not ripe for the creation of a regular trained forest service, though I cannot doubt that that will eventually be necessary. What I at present suggest is the employment of a few skilled inspectors who would travel about, select the forests which it is desirable to preserve, work out schemes for their economical but efficient management, and generally advise the local Governments. I must point out that such advice as Kew can afford to the Secretary of State on papers submitted to it can only be of a vague and general kind. A man of trained experience, brought face to face with the problem on the spot, is in a very different and more effective position.

"The first point which these inspectors would attack, and it cannot be too soon undertaken, is, to use the words of a distinguished Indian forest officer which I have already quoted in another communication, 'to take stock of the forest lands still at the disposal of the Government, select the most suitable, demarcate off with well-marked boundaries, ascertain if any rights exist, and settle them, and then, after careful examination, draw up a scheme of working suitable to each.'

"I have entered into these considerations because they appear to me to be the only ones upon which any satisfactory results can be based in dealing with the forest question in our tropical possessions in West Africa."

Subsequent to this a considerable amount of correspondence and discussion took place on the proposed Forestry Department, and on the advisability of amalgamating the Botanical Departments already in existence, both in the Lagos Colony and Southern Nigeria, with the Forestry Department. It may perhaps be sufficient here to give a few extracts from the letter,* addressed by the Secretary of State for the Colonies, to the Secretary of State for India, requesting the services of a few Forestry Officers with Indian training and experience, and in which the various proposals took a more definite form. The final result was the amalgamation of the Botanical and Forestry Departments of the two Colonies, Lagos and Southern Nigeria, under one head.

It may be mentioned that it was not considered possible at this period for any effective action to be taken in the same scheme with regard to Northern Nigeria.

In the course of the communication referred to it was stated that "The Director of the Royal Gardens at Kew, who is the regular adviser of this Department in such matters, is strongly of opinion that in order to secure the economical and efficient working of the valuable rubber and timber forests which exist in West Africa, the methods of forest administration which are so successfully used in India should be applied to them, and it is desired to organize a Forest Department in Southern Nigeria for this purpose. Sir W. T. Thiselton-Dyer and Sir R. Moor have been in semi-official communication on the subject with Mr. H. C. Hill, the Conservator-General of Forests in India, and it is understood that Mr. Hill has been good enough to express his willingness to select the officers required."

"The duties of the Department, so far as it is possible to detail them at present, would be as follows :—

"(*a*) The conservation of the forests in the Protectorate and the prospecting of the forest areas with a view to ascertaining the value of vegetable economic products.

"(*b*) The protection of all trees and plants affording known economic products, and the exploitation of such as may afford economic products now unknown.

"(*c*) The supervision of concessions that may be granted for the exploitation of vegetable economic products.

"(*d*) The creation of Government reservations and the planting of them.

"(*e*) The reafforesting of exhausted areas.

"(*f*) The preparation of the scheme of legislation necessary to deal with the forests generally, and particularly such trees and plants as are known to afford economic products.

"(*g*) The management and care of existing Botanic Stations and experimental planting therein with a view to the introduction of further economic trees and plants. (There are plantations of coffee at these stations amounting in all to about 100,000 trees now bearing.)

"(*h*) Improvement in the methods of extracting and obtaining vegetable products and preparing them for market.

"(*i*) The training of the native staff for forestry and botanical work, and the general instruction of apprentices.

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* Colonial Office, Sept. 21st, 1901. *See* Botanical Enterprise in W. Africa, 1889–1901, p. 306.

"The foregoing points are given as an indication, which should not, however, be regarded as exhaustive, of the work of the Department in order to enable the Government of India to select suitable officers."

Special attention was directed to the manner in which the rubber and timber forests, chiefly in Lagos, had been impoverished by reckless tapping and cutting, and it was urged that one of the main objects of the Department should be to prevent a similar exhaustion of natural resources in Southern Nigeria.

In response to the request of the Colonial Office, Mr. H. N. Thompson, of the Indian Forestry Service, was appointed Conservator of Forests, Southern Nigeria (original area), in 1902, and later (June, 1905) his authority was extended to Lagos, now the Western province of Southern Nigeria. The Forestry and Agricultural Departments of Lagos were embodied in the Forestry and Botanical Department of Southern Nigeria, on the 28th June, 1905.

Mr. P. Hitchens had been Inspector of Forests since 1899, and had done good work in laying the foundation for the protection and development of the rubber and timber industries, more especially in the Benin districts. On the appointment of Mr. H. N. Thompson as Conservator, Mr. Hitchens was appointed an Assistant Conservator of Forests, first grade, and afterwards as the Department developed he became Provincial Forest Officer of the Eastern province.

Rules of Procedure and Forest Organization * were made (January, 1905) before the amalgamation above mentioned was effected, and no reference therefore is made in them of the Western province. They were drawn up by the Conservator and shew the general and effective lines on which the Department is controlled.

The scheme dealt with the organization of the Staff, European and Native; Collection of Herbarium Specimens; Inspection and Supervision of Timber Concessions; Rubber Nurseries and Plantations; Reports and other Official Returns, and the Organization of Administrative and Executive Charges.

The investigation of the Sylvicultural requirements of the more important species of plants was regarded as one of the most important duties of the Forest Officer, and special attention was directed to those species which supply valuable and durable timber to the Natives, or furnish produce of economic value.

Legislative measures had been put into operation before this, for the preservation of the forests. Rubber had for some time been provided for in a separate Proclamation and again under the first General Forestry Proclamation of 1901. Both the Timber and Rubber Regulations made under this Proclamation have since been repealed by Rules No. 6 and 7 of 1905, under the Forestry Proclamations of 1901 and 1905, all of which were published in the Southern Nigeria Government Gazette of August 18th, 1905.

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* These Rules are published in full in the Southern Nigeria Gazette, No. 13, May 12th, 1905, pp. 255-264.

It is satisfactory to note that in 1905,* less than five years after its inception, the Revenue of the Department was:—

"(*a*) For major forest produce (timber),	£6,302 17 4
"(*b*) For minor forest produce (rubber),	£653 10 0

giving a total of £6,956 7*s.* 4*d.* against an expenditure during the same period of £8,444.

The position as regards NORTHERN NIGERIA is conveyed in the following note communicated to the Director of Kew in May, 1907, by Mr. W. R. Elliott, the Conservator of Forests:—"A piece of Forest situated near Lokoja was declared a Forest Reserve and our main efforts have been devoted so far to the propagation and planting of the different rubbers, especially *Funtumia elastica.*

"At the beginning of 1907 large nurseries of *Funtumia* were formed, and later on over 100 acres of the Lokoja Reserve, which is about 250 acres in extent, were planted up and the remainder will be done this year. In addition to this 40 acres of forest were planted up on the Guara river where we have a Reserve of over 100 square miles, and a further 40 acres in Dakino in the Bassa province. The idea we are working on is to get the natives to plant up the forest surrounding their towns and villages with *Funtumia.*

"Our Forest Reserve on the Guara river is full of splendid mahogany (*Khaya senegalensis*) and ebony (*Diospyros mespiliformis*), as well as many other valuable timber trees. By the new Forestry Proclamation the cutting of these trees is forbidden excepting under the supervision of the Forestry Department, and it is hoped that a stop will be put to the cutting of the young trees for firewood."

Speaking generally of the forests, Mr. Elliott says:—"They are mostly found in the provinces south of the Benue and Niger, viz.: Illorin, Kabba, and Bassa; in the Nassarawa province, which is north of the Benue, and on the banks of some of the larger rivers, such as the Niger, Benue, and the Guara. They do not cover such enormous stretches as they do in the Niger delta, and every effort should be made to preserve them. It is in these southern provinces that I consider most useful work can be done at once by the Forestry Department, and the formation of reserves of both timber and rubber should be taken in hand."†

The vacancy in the office of Conservator of Forests, owing to Mr. Elliott's death in March, 1908, has been filled by the appointment of Mr. B. E. B. Shaw, formerly Assistant Conservator. The latter post has been filled by the appointment of Mr. A. M. McKee.

The Protection of the Forests and Forest Produce in Northern Nigeria is now provided for in Proclamation No. 6, 1906, enacted by the High Commissioner (Sir Frederick Lugard), which came into operation on the 25th April, 1906.

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* Col. Rep., Ann., No. 512, 1906, for 1905, p. 27.
† Kew Bulletin, 1907, p. 248.

DICOTYLEDONS.

POLYPETALAE.

RANUNCULACEAE.

CLEMATIS, Linn.

Clematis grandiflora, *DC.*; Fl. Trop. Afr. I. p. 7.

Obeyon, Cross River.

In Sierra Leone the bruised leaves are used as a vesicant (Mus. Kew).

Clematis Thunbergii, *Steud.*; Fl. Trop. Afr. I. p. 6.

Ill.—Harvey, Thes. Cap. i. t. 8.

Lagos.

Used like preceding (Herb. Kew).

DILLENIACEAE.

TETRACERA, Linn.

Tetracera alnifolia, *Willd.*; Fl. Trop. Afr. I. p. 12.

Ill.—Pobeguin, Fl. Guin. Franç., t. 42.

Brass.

Stems when cut transversely yield a supply of potable fluid (Pobéguin, Essaî sur la Flore de la Guinée Française, p. 195).

Tetracera potatoria, *Afzl.* ex G. Don, Gen. Syst. I. p. 69.—*T. obtusata*, Planch. in Fl. Trop. Afr. I. p. 12.

Lagos, Abeokuta.

Used like preceding (Stapf, in Johnston, Liberia, ii. p. 574).

ANONACEAE.

ANONA, Linn.

Anona Cherimolia, *Mill.*; Fl. Trop. Afr. I. p. 16.

Ill.—Bot. Mag. t. 2011 (*A. tripetala*); Gard. Chron. xviii., 1895, pp. 734–735, xxviii., 1900, p. 460; Rev. Hort. 1905, pp. 86–87; Sem. Hort. 1899, pp. 237 and 239; Le Jard. 1889, p. 90.

Fructo do Condo (Loanda, Welwitsch); Cherimoyer.

Native of the Andes of Ecuador and Peru. Cultivated in the Botanic Gardens of S. Nigeria.

The flowers have a perfume resembling that of *Magnolia fuscata*, and are said to be put into snuff as a substitute for the Tonquin Bean. The pulp is employed as a medicine for the alleviation of inflamed ulcers and for the maturing of abscesses. The seeds of this as well as of other species of *Anona*, when reduced to powder, are used as an insecticide. The fruit is much esteemed for dessert, and said to be superior in this respect to all other Anonas.

Plants may be propagated from seed. A fairly rich soil, plenty of moisture, and a climate approaching to sub-tropical, are conditions required for the cultivation. The hilly districts of Nigeria would perhaps meet these requirements.

Ref.—"Cherimoyer," Kew Bull. Aug. 1887, pp. 15 and 16.

Anona muricata, *Linn.;* Fl. Trop. Afr. I. p. 16.

Ill.—Buchoz. Herb. tt. 7, 88; Nooten, Fl. Java, t. 33; Plenck, Ic. t. 461; Contr. U.S. Nat. Herb. ix. t. 33; Le Jard. 1889, p. 167.

Sour-sop.

Introduced from the West Indies. Cultivated in gardens and farms.

The fruit is eaten by the natives and Europeans, and is commonly sold in the markets. A decoction of the root is said to be an antidote against fish-poison (Fawcett, Economic Products, Jamaica, p. 10), and an infusion of the leaves is used as a remedy for dysentery (Cook & Collins, Economic Plants of Porto Rico, p. 81).

May be propagated from seed; plants grow and fruit freely in almost any soil.

Anona palustris, *Linn.;* Fl. Trop. Afr. I. p. 16.

Ill.—Bot. Mag. t. 4226; St. Hil Pl. us. Bres. t. 30.

Alligator apple; Monkey apple; Cork wood.

The fruit is said to be narcotic and sometimes poisonous. Alligators and cattle are said to like it (Mus. Kew). The wood is employed for stopping casks and bottles and for lining boxes (Mus. Kew); in Jamaica it is used as floats for fishing nets, and as stoppers for mouths of Calabash vessels (Fawcett, Econ. Prod. Jamaica, p. 11); and in Porto Rico for rafts (Cook & Collins, Econ. Pl. Porto Rico, p. 81). The soft and porous roots are used in Cuba as razor strops (l. c. p. 81).

The plant could be propagated by seeds; it thrives on swampy ground, muddy river banks, &c.

Anona reticulata, *Linn.;* Fl. Trop. Afr. I. p. 15.

Ill.—Bot. Mag. tt. 2911–12; Nooten, Fl. Java, t. 32; Tuss. Ant. i. t. 29; Le Jard. 1889, p. 125.

Custard apple; Bullock's heart.

Introduced from the West Indies.

The fruit is eatable and is an antidysenteric and a vermifuge. The dry unripe fruit yields a black dye; the leaves, from which a good quality of Indigo may be obtained, and the young twigs are used in India for tanning; also a good fibre may be prepared from the bark of the young twigs (Watt, Dict. Econ. Prod. Ind.).

Propagation from seed.

Anona senegalensis, *Pers.*; Fl. Trop. Afr. I. p. 16.

Ill.—Deless. Ic. i. t. 86.

Vernac. names.—Diorgud (Gambia, Kew Bull. 1893, p. 371) Maiolo, Malolo (Angola, Cat. Welw. Afr. Pl. i. p. 8).

Niger ; Bornu ; Lagos.

The fruit is edible. On the Gambia the leaves, heated and soaked in water, are used as a cure for diarrhœa (Kew Bull. 1893, p. 371). In Senegal the bark of the stem and roots is used as a vermifuge ; the powdered root for the cure of sores caused by Guinea worm, and both branches and roots are utilized to make a drink in pectoral affections (Sébire, Pl. Util. Sénégal, p. 3). On the Zambesi the root-bark is used as a remedy for snake-bite (Herb. Kew). The petals are used on the Niger for flavouring country dishes (Kew Bull. 1893, p. 371).

Propagation may be effected by seeds. The nature of the soil appears to be of secondary consideration. Scott Elliot refers to it as growing on hard dry laterite in Sierra Leone (Herb. Kew), and Welwitsch mentions a dwarf *Anona* (attributed by Hiern, Cat. Welw. Afr. Pl. i. p. 6, to this species) which he had observed in Huilla at an altitude of 4,000 feet and upwards, and which appeared to spread over most of the mountainous regions of Tropical South Africa.

Anona squamosa, *Linn.* ; Fl. Trop. Afr. I. p. 16.

Ill.—Bot. Mag. t. 3095 ; Tuss. Ant. iii. t. 4 ; Blume, Java, i. t. 53 ; Nooten, Fl. Java, t. 5 ; Plenck, Ic. t. 462 ; Contr. U. S. N. Herb. ix. t. 34 ; Dict. Sc. Nat. t. 118 ; Lam. Encycl. t. 494 ; Le Jard. 1889, p. 125.

Sweet-sop or Sugar-apple (West Indies) ; Custard-apple (India).

Native of South America ; introduced from the West Indies.

The fruit has a pleasant flavour but is inferior to the Sour-sop. Medicinally it is used as a maturant for malignant tumours. In India the juice is used to flavour ice puddings ; the dried unripe fruit, powdered and mixed with gram flour, is used to destroy vermin ; the root is a purgative ; the leaves are an anthelmintic, and are used for the extraction of Guinea worm (Watt, Dict. Econ. Prod. Ind.).

Plants propagated from seed are of quick growth and come into bearing in about three years. A deep stony soil, enriched with humus, and good drainage are the conditions essential to successful cultivation.

In India the tree grows to perfection in the most rocky, hot and barren parts of the country, and in a purely wild state it sometimes grows out of crevices of rocks and old walls (Woodrow, Gardening in India, p. 144).

UVARIA, Linn.

Uvaria Chamae, *P. de Beauv.* ; Fl. Trop. Afr. I. p. 22.

Ill.—Pal. de Beauv. Fl. Ow. Ben. ii. t. 83 ; Guillem. Perr. Rich. Fl. Senegamb. t. 3, fig. 2 ; Engl. Monogr. Afr. Pflan. *Anonac.* t. 3.

Vernac. names.—Eruiju (Lagos, *Dawodu*) ; Arogu (Lagos, *Millen*).

Nupe ; Lagos.

Wood used for oars on river Casamance in Senegal; infusion of leaves employed as an eye-wash (Sébire, Pl. Util. Sénégal, p. 7). Decoction of root said to be drunk in Lagos and also used as lotion for swellings (Millen, Herb. Kew). This plant is said to be an ingredient in "Agbo" a popular medicine in Lagos (see under *Xylopia aethiopica*).

HEXALOBUS, A. DC.

Hexalobus senegalensis, *A. DC.;* Fl. Trop. Afr. I. p. 27.

Ill.—Guillem. Perr. Rich. Fl. Senegamb. t. 2; Engl. Monogr. Afr. Pflan. *Anonac.* t. 20, f.B (*Hexalobus monopetalus*, Engl.).

Nupe.

The roots, stem and leaves, used in Senegal as expectorants, and for the cure of diarrhœa (Sébire, Pl. Util. Sénégal, p. 7; *Uvaria monopetala*, Guill. et Perr.).

XYLOPIA, Linn.

Xylopia aethiopica, *A. Rich.*; Fl. Trop. Afr. I. p. 30.

Ill.—Engl. Monogr. Afr. Pflan. *Anonac.* t. 21.

Vernac. names.—Eru (Lagos, *Dawodu*); Chufani (Nupe, *Dalziel*); Kimba (Hausa, *Dalziel*); Sabongo, Cabella (Angola, *Welwitsch*); Ogano, Okola (Congo, *De Wildeman*); African Pepper.

Lagos; Old Calabar; Eppah, Niger.

The black quill-like, aromatic and pungent fruits are used as a condiment, and in medicine as a stimulant; commonly sold in the native markets (Mus. Kew). The fruits according to De Rochebrune, contain an essential oil, a resin and a new alkaloid "Anonaceine," which crystallizes in well-formed prisms. The volatile oil is described as possessing an agreeable, aromatic, cinnamon-like odour and taste, occurring in the bark, leaves and bast as well as in the fruit (Pharm. Journ. [4] xiii. p. 640). In France the fruits have been used with success for bronchitis, gonorrhoea, and other mucous discharges (Pharm. Journ. [3] xvii. p. 328).

The plant appears to be the chief ingredient of "Agbo" a decoction of leaves and roots, used in Lagos as a medicine for children. Specimens of plants used in the preparation of this medicine were sent (1901) to Kew for determination: no plants containing any poisonous principle were identified; the most important from a medicinal point of view were *Xylopia aethiopica*—a stimulant; *Uvaria Chamae*—a purgative; *Waltheria americana*—a febrifuge; and *Vernonia cinerea*—also a febrifuge. It is difficult to understand the principles underlying its application, since the composition varies in different towns, and with different tribes, and also according to the complaint for which some particular plant of the mixture is considered a specific remedy (Dawodu, Report to Governor of Lagos, 21st April, 1901).

A special Commission appointed to inquire into the infantile mortality in Lagos, regarded the indiscriminate use of Agbo as one very direct and serious cause, although they considered it to be harmless if properly prepared by a competent person and administered as a medicine only, and as an aid to digestion. A great fault appears to lie in its substitution at times for mother's milk.

The wood has been described as light and easy to work ; used in French Guinea for planks and furniture (Pobéguin, Fl. Guin. Franç. p. 58).

Enantia polycarpa, Engl. et Diels in Engl. Monogr. Afr. Pflan. *Anonac.* p. 69.

[*Xylopia polycarpa*, Oliv. in Fl. Trop. Afr. I. p. 32.]

Vernac. names.—Gbeido, Geybido ; Abeokuta bark ; Cantar or Kanda bark ; Yellow Gbeyido.

Lagos.

An extract is used for dyeing skins and mats a yellow colour (Technologist, 1865, p. 562) ; applied by the natives as a specific for ulcers (*id.* 1863, p. 364). In Sierra Leone an extract of the bark is used as an unguent for sores (Herb. Kew).

MONODORA, Dunal.

Monodora angolensis, *Welw.* ; Fl. Trop. Afr. I. p. 38.

Ill.—Engl. Monogr. Afr. Pflan. *Anonac.* t. 29 ; Trans. Linn. Soc. xxvii. t.

Vernac. names.—Gipepe (Jipepa or Xipepe) de Songa (Angola, *Welwitsch*).

Old Calabar.

The seeds are used like those of *M. Myristica* (Welwitsch).

Monodora Myristica, *Dun.* ; Fl. Trop. Afr. I. p. 37, and var. *grandiflora*, Oliv. in Fl. Trop. Afr. I. p. 38.

Ill.—Bot. Mag. t. 3059 ; Engl. Monogr. Afr. Pflan. *Anonac.* t. 30 ; (var. *grandiflora*) Benth. Trans. Linn. Soc. xxiii. tt. 52, 53 ; Bot. Mag. t. 7260.

Vernac. names.—Mpoussa, (Congo, *De Wildeman*) ; Lakose (Lagos, *Punch*, var. *grandiflora*).—Calabash Nutmeg ; Muscades de Calabash ; American Nutmeg.

Old Calabar ; Ibadan.

The seeds are aromatic ; used by the natives as a condiment (Mus. Kew) and for making various tonic, stimulating and stomachic medicines (Welwitsch). H. Thoms has found that the seeds yield 7 per cent. of a yellow essential oil with a greenish fluorescence, and a very pleasant odour, and that no myristicin, or other phenolic esters, such as occur in nutmeg or mace, can be detected in them (Pharm. Journ. [4] xviii. p. 617).

The wood is hard and fine-grained ; bark grey and rugged, 5–8 mm. in thickness (Mus. Kew, specimen from Uganda).

Monodora tenuifolia, *Benth.* ; Fl. Trop. Afr. I. p. 38.

Ill.—Engl. Monogr. Afr. Pflan. *Anonac.* t. 28, f. B.

Eppah, Aghamia on the Niger ; Old Calabar.

Fruits as in *M. Myristica.*

MENISPERMACEAE.

COCCULUS, DC.

Cocculus Leaeba, *DC.;* Fl. Trop. Afr. I. p. 44.

Ill.—Thonner, Blütenpfl. Afr. t. 48.

Vernac. name.—Sangol (Senegal).

Kouka ; Bure, near Lake Chad.

The root is used by the natives in Senegal and in the French Sudan for the cure of periodic fevers. Heckel and Schlagdenhauffen have found in it about 2 per cent. of pelosine and about 3 per cent. of a new crystalline alkaloid, "sangoline." The root also contains columbin, and it is very similar to Pareira Brava, both in appearance and properties (Pharm. Journ. [4] iii. p. 293). Used in Sind and Afghanistan in intermittent fevers and as a substitute for the "*Cocculus Indicus*" (*Anamirta paniculata*, Colebr.), and said to be used as a partial substitute for hops in Indian beer (Dict. Econ. Prod. Ind.).

Ref.—" Sangol (*Cocculus Leaeba*) du Sénégal et du Soudan," Heckel et Schlagdenhauffen, in Ann. Inst. Col. Marseille, 1895, pp. 51–64.

CISSAMPELOS, Linn.

Cissampelos Pareira, *Linn.;* Fl. Trop. Afr. I. p. 45.

Ill.—Bentl. and Trimen, Med. Pl. t. 15 ; Spach, Suites, t. 62 ; Good, Fam. Fl. t. 93 ; Plenck, Ic. t. 723 ; Collett, Fl. Siml. p. 19 ; Vidal, Fl. For. Filip. t. 1c.

False Pareira Brava ; Velvet Leaf ; Ice Vine.

Lagos ; Old Calabar ; Bornu.

The dried root, which is aromatic and bitter, is used in India as a mild tonic and diuretic, and for various medicinal purposes, generally administered as a decoction and extract ; applied externally to cuts, snake-bites, and scorpion stings. The leaves are applied to abscesses (Dict. Econ. Prod. Ind.). In British Central Africa the trailing stems are used to bind the rims of baskets (Cameron, Herb. Kew).

Var. *owariensis*, Oliv. Fl. Trop. Afr. I. p. 46.

Vernac. name.—Je-in-Joko or Jo-Ko-Je (Yoruba, *Millson*).

Lagos ; Yoruba.

Used in Yoruba as an anti-emmenagogue (Kew Bull. 1891, p. 208).

Ref.—Fam. Fl. and Mat. Med. Peter P. Good, ii. No. 93.

NYMPHAEACEAE.

NYMPHAEA, Linn.

Nymphaea Lotus, *Linn.*; Fl. Trop. Afr. I. p. 52.

Ill.—Bot. Mag. tt. 797, 1280 (*N. rubra*), 1364 (*N. rubra rosea*), 4665 (*N. devoniensis*) ; Delile, Egypte t. 60 f. 1 ; Pal. de Beauv. Fl. Ow. Ben. ii. t. 88 ; Andr. Rep. vi. t. 391 ; Desc. Ant. viii. t. 597 ; Rchb. Exot. i. t. 14.

Oware; Niger; Old Calabar.

In Angola the plant is used for food (Welwitsch); in Senegal for various medicinal purposes (Sébire, Pl. Util. Sénégal, p. 12). In India the roots, boiled or raw, flowering stems, cooked in curries, young fruits, as vegetable, and the roasted seeds are all used for food (Dict. Econ. Prod. Ind.). In Lagoa de Quilanda, according to Welwitsch, the plant grows in such enormous quantities, together with *Lemnaceae*—especially *Lemna arrhiza*, and *Pistia Stratiotes*—that the natives make heaps on the banks to serve as manure (Hiern, Cat. Welw. Afr. Pl. i. p. 22).

The plant is under cultivation at Kew, together with the varieties *dentata* (Bot. Mag. t. 4257), *devoniensis* (Bot. Mag. t. 4665) *monstrosa*, *Ortgiesiana*, *pubescens*, *rubra* (Bot. Mag. t. 1280) and *thermalis*. *N. Lotus* var. *Vosgiesiana* is a variety recorded from Northern Nigeria.

Nymphaea stellata, *Willd.*; Fl. Trop. Afr. I. p. 52.

Ill.—Bot. Mag. t. 2058; Andr. Rep. v. t. 330; Fl. d. Serres. t. 854; Wight Ic. Pl. Ind. or. i. t. 178; Wood, Nat. Pl. i. t. 33.

Vernac. name.—Izibo (Zululand).

Niger.

In Zululand and Natal the tuber, after being boiled, is eaten by the natives in times of scarcity (Kew Bull. 1898, p. 53).

In India the roots and seeds are eaten in times of scarcity (Dict. Econ. Prod. Ind.). In Senegal the seeds are eaten made up like "Couscous" [an Arabian dish consisting of very small balls of minced meat and flour, fried in oil]. The fleshy rhizomes are said to yield a dye finer than that obtained from Logwood (Sébire, Pl. Util. Sénégal, p. 12).

This plant and four varieties are in cultivation at Kew:—viz., var. *albiflora*, *coerulea* (Delile, Egypte t. 60, f. 2; Bot. Mag. t. 552), *scutifolia*, and *zanzibarensis* (Bot. Mag. t. 6843; Rev. Hort. 1897, p. 328).

PAPAVERACEAE.

ARGEMONE, Linn.

Argemone mexicana, *Linn.*; Fl. Trop. Afr. I. p. 54.

Ill.—Bot. Mag. t. 243; Lam. Encycl. t. 452; Schk. Handb. t. 141; Desc. Ant. v. t. 380; Wight, Illust. t. 11; Gray, Gen. t. 47; Bailey, Pois. Pl. p. 3; Agric. Gaz. N. S. Wales, ii. t. 23; Transv. Agric. Journ. v. t. 227.

Vernac. names.—Akawn-Ekkun (Yoruba, *Millson*); Mexican or Prickly Poppy; Golden Thistle of Peru; Devil's Fig.

Oshogbo, Yoruba. Introduced; the plant is widely distributed in the Tropics both of the Old and New World.

The seeds possess acrid, emetic, and cathartic properties, and are poisonous in large quantities. They yield an oil used for medicinal purposes in India, West Indies, Senegal, Yorubaland, &c.; but considered unfit for food on account of its laxative character and acrid taste. The oil may be useful as an illuminant or for soap-making (Pharm. Journ. [4] xxiii. p. 599); and also as a preventive against the attacks of the white ants and borers (Agric. Ledg. No. 5, 1907, p. 37). In Mexico it is used for furniture polish (Loudon, Encycl. Pl. p. 1056), and in S. America where it is also employed by painters (Agric. Ledg. No. 5, 1907, p. 37). Two samples of oil from Bengal, examined at the Imperial Institute, were classed as drying oils. (For analysis *see* Tech. Rep. and Sci. Papers, Imp. Inst. pp. 126–127.)

The plant is a common weed in many places, and its cultivation would doubtless be easy. A light rich soil is most suitable. It is remarkable for standing drought well, and for the ample production of seed.

Ref.—Dict. Econ. Prod. Ind.—"An Account of the Genus Argemone," Prain, in Journ. Bot. 1895, pp. 209, 308.—"The Seeds and Oil of the Mexican Poppy," D. Hooper, in Agric. Ledg., No. 5, 1907, pp. 35–39.—"The Weeds of New South Wales" (*Argemone mexicana*), Agric. Gaz. N.S. Wales, April, 1891, p. 175.

CAPPARIDACEAE.

GYNANDROPSIS, DC.

Gynandropsis pentaphylla, *DC.;* Fl. Trop. Afr. I. p. 82.

Ill.—Rheede, Hort. Mal. ix. t. 24; Gray, Gen. t. 78; Mart. Fl. Bras. xiii. pt. i. t. 58.

Vernac. names.—Ekuya (Yoruba, *Millson*); Mozêmbue or Mozambue (Loanda, *Welwitsch*).

Oshogbo, Yoruba; Niger; Kouka; Bornu. Cosmopolitan in the Tropics.

In Yoruba the natives use the roasted leaves as a cure for earache, the juice also is mixed with palm-kernel oil and squeezed into the ear. The leaves are used as a pot-herb in Nigeria and in India (Watt), and eaten like spinach by the natives of Loanda (Welwitsch).

The seeds are anthelmintic, and together with the leaves are applied to various medicinal purposes in India (Watt).

The plant is said to yield an acrid volatile oil, having the properties of garlic or mustard oil; and to possess the antiscorbutic properties of *Nasturtium* and *Cochlearia* (Planchon & Collin, Drog. Simpl. ii. p. 822).

MAERUA, Forsk.

Maerua angolensis, *DC.;* Fl. Trop. Afr. I. p. 86.

Ill.—Guillem. Perr. Rich. Fl. Senegamb. t. 7 (*m. senegalensis*); Deless. Ic. iii. t. 13.

Nupe.

The wood is yellowish, of fine close grain, very hard and heavy, suitable for joinery work, and capable of taking a fine polish (De Wildeman, Pl. Util. Congo, Art. xxvi. p. 379).

CADABA, Forsk.

Cadaba farinosa, *Forsk.;* Fl. Trop. Afr. I. p. 89.

Ill.—Deless. Ic. iii. t. 8.

Bornu, Kouka.

In Senegal a decoction or an infusion is used in pulmonary affections, dysentery, fever, and rheumatics (Sébire, Pl. Util. Sénégal, p. 17).

BOSCIA, Lam.

Boscia senegalensis, *Lam.;* Fl. Trop. Afr. I. p. 92.

Ill.—Lam. Encycl. t. 395.

Kouka.

In Senegal the natives eat the fruits cooked like "Couscous" (see under *Nymphaea stellata*)*;* the parched seeds form a substitute for coffee, and the leaves with salt make poultices for the cure of swellings (Sébire, Pl. Util. Sénégal, p. 17).

CRATAEVA, Linn.

Crataeva religiosa, *Forst.;* Fl. Trop. Afr. I. p. 99.

Ill.—Lam. Encycl. t. 395; Bedd. Fl. Sylv. t. 116; Vidal, Fl. For. Filip. t. 6c.

Bornu.

The bark boiled in oil is considered good for rheumatism (Mus. Kew). In India the bark is used for various medicinal purposes, and the leaves, bruised with vinegar, lime-juice, or hot water, made into a poultice, are considered superior, as a rubefacient and vesicant, to both the mustard seeds and the mustard flour imported from Europe (Dict. Econ. Prod. Ind.). The fruit is edible. The pulp mixed with mortar makes a cement, and the rind is used as a mordant in dyeing. The wood is yellowish-white, when old turning light brown; moderately hard, and even grained; not very durable and very liable to attacks of boring beetles; used in India for drums, models, writing boards, combs, and in turnery (Gamble, Man. Ind. Timb. 2nd ed. p. 32).

MORINGEAE.

MORINGA, Juss.

Moringa pterygosperma, *Gaertn.;* Fl. Trop. Afr. I. p. 101.

Ill.—Rheede, Hort. Mal. vi. t. 11; Wight, Illust. t. 77; Bedd. Fl. Sylv. t. 80; Vidal, Fl. For. Filip. t. 38; Journ. Bomb. N.H. Soc. ix. t. 50; Greshoff, Nutt. Ind. Pl. t. 17; Contr. U.S. Nat. Herb. ix. t. 58; Pobéguin, Fl. Guin. Franç. t. 27.

Horse-radish tree.

N. Nigeria. Introduced to West Africa. Wild in the forests of W. Himalaya and Oudh. Cultivated in other parts of India, Burma, and the W. Indies.

From the seeds an oil known as "Oil of Ben" is obtained, suitable for lubricating watch springs, and other delicate machinery. It is stated to be valuable for ointments, since it keeps for almost any length of time without becoming oxidized. This property, combined with the clear colour, absence of smell and taste, renders it of considerable value for the extraction of perfumes.

A sample of seeds from Northern Nigeria was examined (1904) at the Imperial Institute and was found to contain 38 per cent. of an almost odorless, pale-yellow oil, with a bland, agreeable taste. The oil consisted of a liquid and a solid portion, with the following composition :—

	Liquid portion.	Solid portion.
Specific gravity	0·914	—
Acid value	15·3	—
Free fatty acids (calculated as oleic acid)	7·7 %	—
Saponification value	189·2	194·4
Ether value	173·9	—
Iodine value	70·7	68·3

The seeds were valued at about £7 per ton, delivered in London, and it was considered that the oil might be able to compete with American refined cotton-seed oil, for edible and culinary purposes (Bull. Imp. Inst. 1904, pp. 118–119).

The root is commonly used in India as a substitute for the ordinary horse-radish (*Cochlearia Armoracia*).

The leaves, flowers, and pods are used with various condiments, and as pot herbs ; the twigs and leaves are good fodder.

Various medicinal virtues are attributed to the different parts of the tree, the root being considered to be the most important. An oil which exudes from incisions in the trunk is said to be good for rheumatism (Beddome, Fl. Sylv. t. 80). A gum obtained from the stem is used in calico printing and native medicine (Mus. Kew).

The bark is classed as a tanning material by Christy (New Comm. Pl. & Drugs, No. 5, 1882, p. 45) ; and it is stated to yield a coarse fibre, suitable for the preparation of paper or cordage (Dict. Econ. Prod. Ind.).

Plants are readily raised from seed ; they grow rapidly and come to maturity early. The soil does not, apparently, require to be of any special character, the tree growing well in rich or poor soil. The tree is said to stand drought well.

Ref.—"On the *Moringa pterygosperma*, or Oil of Ben Tree and its Uses, Economical and Officinal" by W. Hamilton, M.B., in Pharm. Journ. [i] v. 1845, pp. 58–59.—"Oil of Ben" in Kew Bull. No. 1, 1887, pp. 7–9 ; *id.* 1892, p. 284.—*Moringa pterygosperma*, Gaertn., The Horse Radish Tree, in Dict. Econ. Prod. Ind. v. Part i. 1891, pp. 276–279.—"Semences de Ben, Noix de Ben" in Les Drogues Simples d'origine Végétale, Planchon & Collin, 1896, ii. pp. 823–824 ; with illustration shewing anatomical structure of the seed.—"The Nature and Commercial Uses of Ben Oil" (oil of "Ben" or "Behen," a fixed oil expressed from the seeds of *Moringa pterygosperma* and *Moringa aptera*), Bull. Imp. Inst. ii. 1904, pp. 117–120.

VIOLARIEAE.

SAUVAGESIA, Linn.

Sauvagesia erecta, *Linn.;* Fl. Trop. Afr. I. p. 111.

Ill.—Aublet, Guiana, t. 100. f. b.; St. Hil. Pl. remarq. Bres. t. 3 f. A.; Mem. Mus. Paris, xi. t. 6; Desc. Ant. iv. t. 220; Spach, Suites t. 42; Browne, Jamaic. t. 12. f. 3.

Herb of St. Martin.

Niger.

The plant is very mucilaginous. Uses:—eye complaints in Brazil; bowel complaints in Peru; and diuretic in the West Indies (Treasury of Botany).

BIXINEAE.

COCHLOSPERMUM, Kunth.

Cochlospermum tinctorium, *Rich.;* Fl. Trop. Afr. I. p. 113.

Ill.—Guillem. Perr. Rich. Fl. Senegamb. t. 21.

Vernac. names.—Feru; Rawaye (Yoruba, *Millson*); Foosca (Gambia, Kew Bull. 1893, p. 371).

Yoruba; Nupe; and the Hausa States in general.

The roots yield a yellow dye well known in the Soudan (Kew Bull. 1893, p. 371), and used by the Hausas in conjunction with Elu (Indigo) for making the sacred green dye, which is a secret trade of certain Hausa families (Kew Bull. 1891, p. 219). The bark makes good rope, largely used by Yorubas and Hausas, and is said to be in sufficient quantity for exportation (Kew Bull. 1891, p. 219).

Uncultivated; said to be very common on a rocky soil.

BIXA, Linn.

Bixa Orellana, *Linn.;* Fl. Trop. Afr. I. p. 114.

Ill.—Berg, Charact. t. 82, n. 587; Spach, Suites, t. 44; Mart. Fl. Bras. xiii. part 1, t. 87; Bedd. Fl. Sylv. t. 79; Buchoz, Herb. Col. Ameriq. t. 83; Vidal, Fl. For. Filip. t. 7 A; Greshoff, Nutt. Ind. Pl. t. 14; Cat. Pl. Hort. Col. Brux. p. 44; Plenck, Ic. t. 428; Contr. U.S. Nat. Herb. ix. t. 39.

Vernac. names.—Quisafu (Angola, *Welwitsch*); Arnatto, Annatto or Annotto.

Native of Tropical America. Widely distributed in most tropical countries; naturalized in West Africa.

The seeds yield the Annatto of commerce, an orange or yellow dye, used for dyeing silks and cotton goods, feathers, &c.; for colouring cheese, butter, jellies, and other foods; plasters, ointments; and brown-leather polish.

The natives of Angola according to Welwitsch (Hiern, Cat. Welw. Afr. Pl. i. p. 38) use the dye for various purposes, amongst them the dyeing of "balagos" or small baskets, made from the straw of a species of *Eleusine*, the manufacture of which forms one of the most valuable industrial productions of the people.

In India, as a dye it is sometimes used in combination with the red powder of *Mallotus philippinensis*, producing a deep orange red (Dict. Econ. Prod. Ind.).

For colouring food-stuffs the Annatto has to undergo special preparation in order to make it perfectly pure and harmless.

The cultivation is comparatively easy, a temperature of about 75° F. with an abundant rainfall being required. It succeeds in almost any well-drained soil, in moist, warm situations, from sea-level to an altitude of about 2,000 feet. It has been grown successfully in the Botanic Garden at Old Calabar, at Abutshi (Woodruff, Rep. to Roy. Niger Co., Nov. 30th, 1889), and at Lagos where it has established itself with little or no cultivation (McNair, Kew Bull. 1890, p. 162).

Plants are easily raised from seed, which may either be sown in nursery beds, and transplanted when about 6 inches high, or sown in permanent places; the distance apart of plants in permanent situations would be approximately 15 feet. Judicious pruning is advisable to keep the plants bushy and to ensure a continuous supply of flowers and seed. It would probably be sufficient, when gathering the ripe fruits, to cut off a portion of each branch at the same time. The plants begin to bear seed when about two years old and continue prolific for several years. It has been estimated that one acre will produce 5 cwt. and upwards of seed, and that one pound of seed will yield approximately 1·5 ozs. of dye (Agric. Ledg. No. 12, 1904, p. 178).

The handsome appearance of the shrub makes it a desirable subject for ornamental purposes, and especially as a hedge plant, since cattle and goats are said not to eat the leaves.

The price of Annatto on the London market varies from 1*s.* to 2*s.* per lb., and of Annatto seeds 4½*d.* to 6*d.* per lb. A sample of seed grown at Onitsha was recently valued in London at about 5*d.* per lb. The cultivation is worthy of little or no extension since competition with other sources does not appear to be advisable.

The demand for the commodity is more or less stationary and has always been distinctly limited.

Details of preparation of the dye and full particulars will be found in the following papers.

Ref.—Kew Bull. No. 7, 1887, pp. 1–8.—No. 9, 1887, pp. 1–4.—No. 43, 1890, pp. 141–144.—Dict. Econ. Prod. Ind. i. pp, 454-457.—"Rocou" in Les Drogues Simples d'origine vegetale, Planchon & Collin, 1896, ii. pp. 786–788.—"The Annatto Dye Plant," I. H. Burkill in Agric. Ledg. No. 12, 1904, pp. 177–187.—"Cultivation and Utilisation of Annatto" in Bull. Imp. Inst. 1908, pp. 171–174.

ONCOBA, Forsk.

Oncoba spinosa, *Forsk.*; Fl. Trop. Afr. I. p. 115.

Ill.—Guillem. Perr. Rich. Fl. Senegamb. t. 10; Lam. Encycl. t. 471; Harvey, Thes. Cap. ii. t. 142.

Vernac. name.—Shauga (Yoruba, *Millson*).

Abeokuta ; Yoruba ; Lagos ; Benin ; Nupe.

Fruits edible, used as ornaments by the natives in most parts of Africa. Snuff-boxes are made from the fruits and used by the Zulus in Natal (Mus. Kew).

In Senegal a decoction of the roots is used in cases of dysentery, and an infusion taken each morning, as an antilithic and diuretic (Sébire, Pl. Util. Sénégal, p. 19).

FLACOURTIA, Commers.

Flacourtia flavescens, *Willd.* ; Fl. Trop. Afr. I. p. 121.

Niger.

Berry edible.

Flacourtia Ramontchi, *L'Herit.* ; Fl. Trop. Afr. I. p. 120.

Ill.—L'Herit. Stirp. Nov. t. 30, 30B ; Lam. Encycl. t. 826 ; Wight, Ic. Pl. Ind. or. i. t. 85 ; Brandis, Indian Trees, p. 40 ; Thonner, Blütenpfl. Afr. t. 105.

Batoko Plum (Zambesi) ; Madagascar Plum.

Abeokuta ; Niger.

The fruits, about the size of a plum, are eaten either raw or cooked. They are considered good for jaundice and enlarged spleen.

In India the leaves are used as cattle fodder ; the thorns for breaking the pustules of small-pox ; the gum with other ingredients for cholera ; and the bark is applied to the body with that of *Albizzia*, in cases of intermittent fever (Dict. Econ. Prod. Ind.).

The wood is red, hard, close and even-grained, durable, splits but does not warp ; weight about 50–55 lbs. per cubic foot ; used for turning, and for agricultural implements (Gamble, Man. Ind. Timb. 2nd ed. p. 40).

The thorny branches suggest its suitability as a hedge plant ; propagated by seed, or by stout branches placed firmly in the ground. It grows in poor, dry, rocky soil.

POLYGALEAE.

SECURIDACA, Linn.

Securidaca longipedunculata, *Fres.* ; Fl. Trop. Afr. I. p. 134.

Ill.—Rich. Tent. Fl. Abyss. t. 10 (*Lophostylis angustifolia*) ; Peters, Mozamb. t. 22 (*Lophostylis pallida*) ; Thonner, Blütenpfl. Afr. t. 79.

Vernac. names.—Womagunguna ; Saingia (Kontagora, *Dalziel*) ; Jalu (S. Nigeria) ; Jodo (E. Africa, *Scott Elliot*) ; Buaze (Zambesi, *Livingstone*).

Quorra.

This plant yields two kinds of fibre, one from the bark of the twigs, known as "Buaze fibre," and the other from the stem—a fibrous bark which becomes enveloped by layers of the wood.

The latter is of low value, but it might be used for the manufacture of rough bags (Bull. Imp. Inst. 1908, p. 20). The Buaze fibre is used by the natives of the Moravi country for stringing beads, according to Livingstone (Kew Bull. Add. Ser. ii. p. 7); and fishing nets are made from it in British Central Africa.

The fibre from the twigs is difficult to extract, and no efficient process of degumming has been discovered. The best results might be obtained if the thin bark were scraped on the spot; and the scraped fibre could then be degummed later (Bull. Imp. Inst. 1908, p. 21). The natives of British Central Africa scrape off a small quantity of the fibre and chew it thoroughly until all the gum is removed (Davy, Bot. Dept. Zomba).

From experiments carried out at the Imperial Institute (Bull. Imp. Inst. 1908, pp. 19–22) it appears that the bark from the twigs is capable of yielding about 37 per cent. of clean fibre. The irregularity in the length of the fibre, due to the much-branched character of the twigs, is a bad feature of the material. It could be used in the place of flax tow. If suitable means of getting rid of the gums can be found, this fibre will be of a useful character.

The seeds contain a drying oil. In certain parts of Africa the following uses have been attributed to the root:—as a remedy for snake-bite and hydrophobia; as an ingredient in an antidote against the Issa arrow poison prepared from the seeds of *Strophanthus gratus;* and as a remedy for stomach complaints; the leaves are considered to be a remedy for snake-bite (Pharm. Journ. [4], xxi. p. 833).

The plant is stated to grow freely in a wild state, but it does not appear to have been cultivated systematically anywhere. Propagation could be readily effected by means of seed. As the best fibre is obtained from the twigs growth in coppice is indicated. Dr. Livingstone and others have noticed that it grows in poor soil among the rocky hills in East and British Central Africa.

Ref.—Kew Bull. Add. Ser. II. 1901, pp. 7–8.—Bull. Imp. Inst. 1908, pp. 19–22.

CARPOLOBIA, G. Don.

Carpolobia alba, *Don;* Fl. Trop. Afr. I. p. 135.

Old Calabar.

The fruit is edible according to Welwitsch (Hiern, Cat. Welw. Afr. Pl. i. p. 48).

Carpolobia lutea, *Don;* Fl. Trop. Afr. I. p. 136.

Vernac. name.—Oshun-Shun (Yoruba, *Millson*).

Lagos; Abeokuta; Niger; Old Calabar.

The wood is very hard, resists the white ant, and is used for house posts and walking-sticks. In Yoruba a decoction of the bark, applied externally and internally is used as a cure for rheumatism. Fruit edible. (Kew Bull. 1891, p. 210.)

PORTULACEAE.

PORTULACA, Linn.

Portulaca oleracea, *Linn.;* Fl. Trop. Afr. I. p. 148.

Ill.—Rheede, Hort. Mal. x. t. 36 ; Schk. Handb. t. 130 ; Tratt. Archiv. ii. t. 13 ; Sibth. Fl. gr. t. 457 ; DC. Pl. grass. t. 123 ; Lam. Encycl. t. 402 ; Gray, Gen. t. 99 ; U.S. Dept. Agric. Rep. Bot. 1887, t. 6 ; Duthie, Field Crops, t. 93 ; Clarke & Fletcher, Farm Weeds, Canada, t. 18 ; Turner, Forage Pl. Austral. p. 7 ; Plenck, Ic. t. 361 ; Bull. Econ. Indo-Chin. 1905, p. 1107.

Purslane ; Pigweed.

A potherb. The young shoots make good salad, and the plant is regarded as a good vegetable, with antiscorbutic properties.

On the Congo the plant is considered good fodder for cattle (De Wildeman, Pl. Util. Congo, Art. xxxi. p. 547) ; eaten readily by all kinds of stock (Turner, Forage Pl. Austral. p. 7).

The seeds are largely used for food by the natives of Australia (Maiden, Austral. Nat. Pl. p. 53). They are said to be a vermifuge, and for this purpose a preparation is recommended consisting of leaves and twigs 2·8 gram., fresh Papaw root 0·75 gram., water 48 oz., the whole boiled down to 32 oz. (Christy, New Comm. Pl. & Drugs, No. 10, 1889, p. 82).

Various medicinal uses are attributed to the leaves and seeds.

Cultivation is easy ; propagated by seeds and grown in light sandy soil.

Portulaca quadrifida, *Linn.;* Fl. Trop. Afr. I. p. 149.

Ill.—Jacq. Collect. ii. t. 17, f. 4 ; Wight, Illust. t. 109.

Lagos ; Niger.

In Lagos the plant is used medicinally. In Egypt the bruised leaves are used as an anticephalic (Planchon & Collin, Drog. Simpl. ii. p. 762).

Uses and culture similar to the preceding species.

TALINUM, Adans.

Talinum triangulare, *Willd.* (*T. crassifolium*, Willd.) ; Fl. Trop. Afr. I. p. 150.

Ill.—Plumier, Ic. Burm. t. 150, f. 2 (*Portulaca foliis obovatis*).

Vernac. name.—Etinyon Mbkara (Eifik).

Niger ; Old Calabar.

Used for salads and as a culinary vegetable.

Propagated readily from seeds and grows in light, rich soil. Cultivated in native farms and gardens.

HYPERICINEAE.

PSOROSPERMUM, Spach.

Psorospermum febrifugum, *Spach;* Fl. Trop. Afr. I. p. 158.

Niger.

The bark is used by the natives of Angola as a febrifuge, and in cases of leprosy (Hiern, Cat. Welw. Afr. Pl. i. p. 57).

HARONGA, Thouars.

Haronga madagascariensis, *Chois.*; Fl. Trop. Afr. I. p. 160.

Ill.—Lam. Encycl. t. 645 (*Harungana madagascariensis*); Drake, Hist. Madagas. t. 336 A.

Vernac. name.—Fasua (Gold Coast, *Johnson*).

Old Calabar.

The leaves are used, on the Gold Coast, for chest complaints (Johnson, Herb. Kew), and in Madagascar as a cure for dysentery (Parker, Mus. Kew).

The fruit is edible and its flavour is said to resemble that of raisins. The seeds are used in cookery in French Guinea, and a beverage like cider is made from them (Pobéguin, Fl. Guin. Franç. p. 82).

A yellow dye is obtained from the inner bark of the tree, (Purves, Mus. Kew).

The wood is used by the natives for posts in houses. It is of great beauty, pale citron in colour with a lustrous surface, and prominent and boldly contrasted silver grain. It takes an excellent polish, but the delicate citron colour disappears and the wood becomes brownish. It works very well and smoothly by saw, planing machine, and lathe. It is as soft as deal, rather fissile, splits straight and finishes without trouble. The structure of this wood has a very remarkable resemblance to that of many Proteaceous plants. If means could be devised to produce a satisfactory finish, otherwise than by French polish, and thus preserve the colour, the wood might be appreciated in England, but in the absence of such a finish its importation could not be recommended. Weight 31·25 lbs. per cubic foot. (Stone, Mus. Kew.)

GUTTIFERAE.

SYMPHONIA, Linn. f.

Symphonia globulifera, *Linn.*; Fl. Trop. Afr. I. p. 163.

Ill.—Mart. Fl. Bras. xii. part 1. t. 108.

Hog Gum; Doctor's Gum; Karamanni Wax.

Old Calabar.

A wax made by mixing the gum with bees wax and powdered charcoal is used by the Indians in British Guiana for cementing arrow-heads and for joining wood (Im Thurn, Mus. Kew). The yellow resin, found at the roots of old trees, is used as a vulnerary and diuretic in topical applications to wounds, in gout plasters and as a substitute for Copaiba (Moloney, Forestry, W. Africa, p. 279). The tree yields a gum-resin like gamboge (Barter, Mus. Kew).

PENTADESMA, Sabine.

Pentadesma butyracea, *Don*; Fl. Trop. Afr. I. p. 164.

Ill.—Heckel, Kolas Afr. pp. 114–116; Hook. Ic. Pl. t. 2465.

Vernac. names.—Kamoot (S. Leone, *Cole*); Lamy (French W. Africa); Ngoumi (Congo, *De Wildeman*); Kanya (*Heckel*): Butter and Tallow Tree.

Niger River.

The seed of this tree yields an edible fat, which first came into notice in this country as a possible article of commerce in 1895, when some specimens of the tree and samples of seed were submitted to Kew by the Government of Sierra Leone. The seeds were found to contain 41 per cent. of oil, which, though not of high quality, was considered suitable for soap making (Kew Bull. 1897, p. 324).

According to a later report (Cons. Rep. Ann. No. 2876, 1902, p. 4) Lamy is worth £8 per ton on the European market, and is employed in candle and margarine manufacture.

These seeds are stated to have been found as an adulterant of Kola nuts (*Cola acuminata*), but they do not contain theine, and differ from the true kola in yielding a certain percentage of fat, and a small quantity of tannin (Year Book, Pharm. 1888, p. 165).

In Sierra Leone the natives use the oil for cooking in the same way as palm-oil. The oil is extracted by drying the seeds and parching them over a fire. They are then pounded in a mortar, water is added, and the whole boiled, the fat or oil is skimmed off as it rises to the surface (Kew Bull. 1897, p. 322).

Propagation by means of seeds.

Ref.—"Beurre de Kanya," or "Oddjendje." Les Drogues Simples d'origine vegetale, Planchon & Collin, 1896, ii. p. 752. Hook. Ic. Plant. 1896, t. 2465.—"Beurre de Kanya," in Ann. Inst. Col. Marseille, 1897, pp. 161–170.—"Butter and Tallow Tree of Sierra Leone," Kew Bull. 1897, pp. 320–325.

Garcinia Kola, *Heckel*, in Journ. Pharm. et Chim. viii. p. 88 (1883).

Ill.—Journ. Bot. 1875, t. 160.

Vernac. names.—Efrie (Uwet, *McLeod*); Bitter Kola; False Kola; Male Kola; Orogbo Kola-nut.

Tree, 20–30 feet (Masters), 10–20 feet (Heckel).

Branches subterete, glabrous, swollen at the nodes; leaf bases prominent, persistent; branchlets green, ascending. Leaves distant, about 6 ins. long, 3 ins. broad, subcoriaceous, glabrous, shining above, paler beneath, ovate oblong, (or elliptic oblong), entire, narrowed at both ends, shortly acuminate, subcuneate at the base; midrib sunk on the upper surface and prominent on the lower; lateral nerves fairly close together, parallel, arching near the margin, intermediate veins densely reticulate. Petioles $\frac{1}{2}$–$\frac{3}{4}$ in. long, corky. Mature fruit baccate, obscurely 4-celled about 3 ins. long and $2\frac{1}{2}$ ins. across, oblong-ovoid, or obovoid, apex obtuse, with remains of the styles at the apex and of five imbricate sepals at the base. Rind subcoriaceous, pubescent, apricot-coloured, resiniferous, covering a juicy, orange acid pulp. Immature fruit cuboid, very obtuse at both ends, deeply 4-lobed. Seed exalbuminous, solitary in each cell, two of them aborting; mature seeds $1\frac{1}{2}$ in. long, $\frac{3}{4}$ in. across, terete-oblong, obtuse at both ends, with a brown parchment-like coat. Embryo fleshy, bitter, resiniferous undivided, tubercled. Cotyledon and radicle not developed till germination (Masters, in Journ. Bot. 1875, p. 65).

Lagos; Agege; Uwet; Old Calabar. Distributed throughout West Africa, between 10° N. and 5° S. lat. (De Candolle, Monogr. Phanerog. viii. 1893, p. 487).

Dr. Masters in 1875 was able to determine that the Bitter Kola was a species of *Garcinia* and placed on record the more prominent characteristics of the plant, though he did not venture on a specific name (Journ. Bot. iv. 1875, p. 65).

According to Milton (Journ. Bot. iv. 1875, p. 65), the newly dried nuts are esteemed by the natives as a remedy in cases of cough, and are said to improve the voice of the singer. The bitter principle is agreeable and free from the astringency of the common red and white Colas, and it imparts to water a pleasant sweet taste. The Bitter Kola is also said to be a good restorative after sea-sickness; it is eaten by the natives to enhance the flavour of liquor (McLeod, Herb. Kew) and used as a remedy for dysentery (Monteiro, Mus. Kew).

The "Bitter Kola" of Sierra Leone, collected by Scott Elliot, belongs to a very different species, obviously allied to *G. punctata*, Stapf, and probably undescribed.

Vesque in De Candolle's Monograph of the Guttiferae (viii. 1893, p. 487) keeps the "Bitter Kola" of Masters separate from that of Heckel, and records it as *G. floribunda*, but states that the two plants are possibly identical. There appears therefore to be some uncertainty as to the exact botanical identity of the Bitter Kola, and while giving Heckel's specific name it is considered preferable to give the original description of Masters, as applying more particularly to the Lagos plant, until flowering specimens have been obtained from W. Africa.

The seeds of the Bitter Kola do not appear to possess the same stimulating properties as those of the true Kola (*Cola acuminata*), and are of less commercial importance. The fresh nuts of Bitter Kola (*Garcinia Kola*) in West Africa are worth 2*s.* for 200 nuts, whilst the value of the nuts of *Cola acuminata* is 3*s.* to 4*s.* 6*d.* for 200 (von Bernegau in Der Tropenflanzer, 1904, p. 361).

The tree is said to flourish under the same conditions as are required for *Cola acuminata*, *q.v.*

Ref.—"Male Kola or Bitter Kola," Heckel & F. Schlagdenhauffen, in Journ. Pharm. Chimie, Ser. 5, viii. 1883, pp. 87–91: Translation in Pharm. Journ. [3] xiv. 1884, p. 586, and in Christy's "New Comm. Pl. and Drugs," No. 8, 1885, pp. 11–12.—"Composition of False Cola," C. Kr., in Just, Jahresb. 1884, ii. p. 92.—"Export of Bitter Cola from Lagos," Warburg, in Der Tropenpflanzer, 1898, pp. 221–223.

Garcinia Mangostana, *Linn.*; Sp Pl. p. 443.

A small tree 20–30 feet, branches many, decussate. Leaves 6–10 in. long, 2½–4¼ in. broad; very coriaceous; nerves regular, close, inarching with an intra-marginal one. Male flowers in 3-9 flowered terminal fascicles; pedicels short. Berry as large as an orange, smooth dark-purple; pericarp firm, spongy. Seeds large, flattened; aril very fleshy, white, juicy (Fl. Brit. Ind. i. p. 260).

Ill.—Rumpf, Amb. i. t. 43 ; Lam. Encycl. t. 405 ; Desc. Ant. i. t. 23 ; Lodd. Cab. t. 845 ; Vidal, Fl. For. Filip. t. 11 F ; Nooten, Fl. Java, t. 8 ; Le Jard. 1888, p. 187 ; Bot. Mag. t. 4847 ; Gard. Chron. Nov. 20th, 1875, pp. 656 & 657 ; Nov. 6th, 1897, pp. 325 & 327 ; Dec. 17th, 1904, pp. 426 & 428 ; Fl. d. Serres, t. 2359–60 ; Pierre, Fl. For. Cochin. t. 54 ; Plenck, Ic. t. 360.

The Mangosteen.

Native of the Malay Peninsula ; cultivated in Ceylon, parts of India, and the West Indies.

The cultivation of this choice fruit in Nigeria may not yet have extended beyond the Botanic Gardens. Plants have been introduced to Lagos and Old Calabar, through the Royal Botanic Gardens, Kew, and although these have not arrived at maturity, their successful development is of sufficient interest and importance to merit some details of the plant being given here.

In Ceylon, Madras, Straits Settlements, Java, and the West Indies the cultivation appears to have been carried to a successful issue, and it is reasonable to expect that it will succeed in Nigeria, more especially in the Southern Colony.

The fruit is regularly shipped from Singapore to Calcutta, but the establishment of a trade between any of the countries of production and the European markets has so far not been accomplished.

A box containing nine fruits of Mangosteen was received at Kew from the Royal Botanic Gardens, Trinidad, in 1897. Each fruit was separately packed in a compartment with pine wool, and owing to the firm consistency of the outer wall of the fruit it travelled well, and was favourably reported on (Kew Bull. 1898, p. 26). Fruits imported in 1904 were, however, not favourably reported on (Gard. Chron. Dec. 17th, 1904, p. 427).

The rind is said to yield a valuable tanning material, and in India it is used in combination with the fruits of *Terminalia Catappa* as a black dye. A decoction of the rind is considered useful in cases of chronic dysentery and diarrhœa, and is said to possess other medicinal virtues (Dict. Econ. Prod. Ind.).

The seeds, although they do not retain their vitality for long, germinate quickly when sown in a fresh state. Plants may be raised in nursery beds or in bamboo pots, and planted out in permanent places when about a year old, at distances of from 18–20 feet. A tropical temperature, heavy rainfall, and an open, rich, loamy soil are indispensable to satisfactory growth.

Garcinia ovalifolia, *Oliv.* ; Fl. Trop. Afr. I. p. 166.

Ill.—Pierre, Fl. For. Cochin. t. 88 C. ; Vidal, Fl. For. Filip. t. 11 A.

Vernac. name.—Bolong (Congo).

Niger.

The wood is used on the Congo for making canoes (De Wildeman, Pl. Util. Congo, Art. xxvi. p. 356).

Ochrocarpus, Thouars.

Ochrocarpus africanus, *Oliv.* ; Fl. Trop. Afr. I. p. 169.

African Mammee Apple.

The pulp of the fruit is eaten by the natives (Mann, Mus. Kew).

MALVACEAE.

SIDA, Linn.

Sida carpinifolia, *Linn.*; Fl. Trop. Afr. I. p. 180.

Ill.—Cav. Diss. t. 134; Vidal, Fl. For. Filip. t. 16 A; St. Hil. Pl. us. Brés. t. 50.

Vernac. name.—Oshekpotufunfua (Yoruba, *Millson*).

Yoruba.

The stem yields an excellent fibre suitable for making rope (Mus. Kew). In Yoruba the bruised stems are used as soap, and the plant is also used in cases of gonorrhœa, applied both internally and externally (Kew Bull. 1891, p. 213).

The roots are used in native medicine (Moloney, For. W. Afr. p. 280).

Sida rhombifolia, *Linn.*; Fl. Trop. Afr. I. p. 181.

Ill.—Cav. Diss. t. 3, f. 4 (*S. retusa*); Bailey, Poison. Pl. p. 5; Mart. Fl. Bras. xii. pt. 3, t. 63; Agric. Gaz. N. S. Wales, 1894, p. 537; Ill. Hort. Ser. 6, iii. 1896, p. 173, f. 19.

Vernac. names.—Denji (Nyasaland, *McClounie*); Escoba (Venezuela).—Sida Hemp; Paddy's Lucerne; Queensland Hemp; Tea Plant (U.S. Amer.).

Widely distributed in Tropical Africa and in the Tropics of the Old and New Worlds.

The fibre is considered superior to Jute (*Corchorus capsularis*), and it has also been suggested as a substitute for Flax (*Linum usitatissimum*) (Dict. Econ. Prod. Ind.). The percentage of cellulose is relatively high, the best samples having been found to contain as much as 83 per cent. For spinning purposes it has been valued at £12 and upwards per ton, according to quality (Bull. Imp. Inst. 1905, p. 25). The method of preparation may be regarded as being much the same as that for Jute (*q.v.*). It has been found that the ribbons are easily detached from the woody stem, and after 14 days immersion in standing water, the fibre is readily separated from the pulp (McClounie, Mus. Kew).

The plant is regarded as good fodder for cattle, sheep, and hogs. Horses do not seem to relish it much, but cattle appear to thrive on it (Dodge, Cat. Fib. Pl. p. 298). On the Congo it is used as forage for horses and cows (De Wildeman, Pl. Util. Congo Art. xxxi. p. 548). It is said to be detrimental to young fowls, but in nowise hurtful to stock (Bailey, Pois. Pl. p. 5).

The mucilaginous stems are used in India as a demulcent and as an emollient (Dict. Econ. Prod. Ind.).

The cultivation would in all probability be easy, since the plant is so widely distributed. The plant is a perennial, but it could be grown as an annual. Seeds germinate, if sown when fresh, in about 10–15 days. For the production of fibre they may be sown broadcast, and it is advisable to sow thickly to prevent branching near the base of the stem. McClounie (Zomba) records an exceptional growth of 8–9 feet in a year, from seedlings, but the general height would in most cases be considerably less. The soil requires to be rich and deep. The best time to cut the stem for fibre appears to be either when the plants are in flower or while the capsules are still green.

Ref.—Dict. Econ. Prod. Ind. vi. pt. 2B, pp. 681–686.—"Paddy's Lucerne or Queensland Hemp," Maiden, in Agric. Gaz. N. S. Wales, Aug. 1894, pp. 537–544.—Bull. Imp. Inst. 1905, pp. 23–24, with an analysis of a sample from Nyasaland, in comparison with Indian Jute.—*Sida rhombifolia*, Linn. in Comm. Prod. Ind. Watt, 1908, pp. 991–992.

Sida urens, *Linn.*; Fl. Trop. Afr. I. p. 179.

Ill.—Mart. Fl. Bras. xii. pt. 3, t. 60.

Widely distributed in Trop. Africa, the West Indies, Peru, Brazil, &c.

Stem yields a good fibre (Mus. Kew).

WISSADULA, Medik.

Wissadula rostrata, *Planch.*; Fl. Trop. Afr. I. p. 182.

Ill.—Mart. Fl. Bras. xii. pt. 3, t. 77 (*W. periplocifolia*).

Vernac. name.—Cahémbia-hémbia (Angola, *Welwitsch*).

Cosmopolitan in the Tropics.

This plant yields a fibre of good quality. A sample from Trinidad, submitted to Kew (1889), was valued in London at £17 per ton, and with some improvement in colour at £20. Another sample from Grenada (1891) was estimated at £14 per ton; while further samples from Trinidad (1899) were valued at from £15–£16 per ton (Mus. Kew).

Commercially the fibre is classed as Jute, and the preparation may be effected in the same way (see *Corchorus capsularis*).

Under cultivation the plant appears to grow freely, producing straight stems 9–10 feet high, from which a fibre can be obtained at least 8 feet long (Mus. Kew). The following particulars of the period of growth and yield per acre have been estimated at the Royal Botanic Gardens, Trinidad:—Seed sown March 15th, 1898; crop cut April 28th, 1899; yield per acre, raw strippings, dried, 1·089 tons; yield per acre of clean bast fibre, 9¼ cwts.; clean material, 42 per cent. of raw strippings, retted four days, then scraped and dried (Kew Bull. 1899, p. 226).

The plant is said to thrive in a barren and rocky soil, the land being prepared simply by burning, and the seeds sown broadcast; the stems are ready to cut in the course of about a year (Dodge, Cat. Fib. Pl. p. 38).

Ref.—"Maholtine (*Abutilon periplocifolium*) as a New Fibre Plant," Hart, in Agric. Rec. Trinidad, i. pp. 217–219.—*Abutilon periplocifolium*, in Descr. Cat. Useful Fib. Pl. of the World, Dodge, Rep. No. 9, 1897, U.S. Dept. Agric. Fiber Investigations.—Kew Bull. 1899, pp. 226–227.

ABUTILON, Gaertn.

Abutilon asiaticum, *Don* ; Fl. Trop. Afr. I. p. 184.

Ill.—Cav. Diss. t. 128, f. 1 (*Sida asiatica*).

Country Mallow.

Niger.

The stem contains a good fibre suitable for cordage (Cross, Bevan and King, Rep. Ind. Fib. p. 34).

See *A. indicum*, for particulars also applicable in this case.

Abutilon indicum, *Don* ; Fl. Trop. Afr. I. p. 186.

Ill.—Wight, Ic. Pl. Ind. or. i. t. 12.

Country Mallow.

Niger ; Abeokuta.

The fibre is considered good for cordage ; equal to Chinese Jute (*Abutilon Avicennae*) ; superior to Indian Jute (*Corchorus capsularis*) ; and finer than Manila Hemp (*Musa textilis*) (Dict. Econ. Prod. Ind.). Its preparation could doubtless be accomplished in the same way as Chinese Jute above mentioned. The method is, in brief, as follows :—The bundles of stems, tied loosely at the tips, are placed upright in standing water, the root half only, being submerged, for two days ; the bundles are afterwards completely submerged. When the bark is sufficiently retted, which may be in four or five days, it is stripped off, washed in clean water, and the fibre spread out in the sun to dry (Kew. Bull. Add. Ser. ii. p. 267).

In India a mucilaginous extract from the leaves is used as a demulcent ; an infusion of the roots is used in fevers as a cooling remedy, and said also to be useful in the treatment of leprosy ; the seeds are used as a cough remedy, and the bark as a diuretic (Dict. Econ. Prod. Ind.). Various other medicinal uses have been attributed to the plant.

Under cultivation the plant may be regarded as an annual, and would probably come to maturity in from four to five months. The seeds may be sown broadcast, or several together at intervals of about 9 inches to a foot ; the seedlings eventually should be thinned out to about 1 foot apart. The soil requires to be rich and in good tilth.

URENA, Linn.

Urena lobata, *Linn.* ; Fl. Trop. Afr. I. p. 189.

Ill.—Cav. Diss. t. 185, f. 1 ; Lam. Encycl. t. 583 (*Urena*) f. 1 ; St. Hil. Pl. us. Brés. t. 56 ; Desc. Ant. iv. t. 271 ; Bot. Mag. t. 3043 ; U.S. Dept. Agric. Fiber Investigations, Rep. 6, 1894, t. 2.

Vernac. names. — Ake-iri (Yoruba, *Millson*) ; Bubo-bubo (Gambia, *Lester*) ; Toja (Lagos, *Moloney*) ; Horse Whip (Sierra Leone, *Cole*) ; Guaxima or Uaixyma, Aramina, Carrapicho (Brazil) ; Banochra (India) ; Caesar Weed (Florida).

Yoruba ; Widely distributed in the Tropical and Sub-tropical regions of both hemispheres.

The bark yields a fibre of good quality, suitable for the manufacture of bags, twine, &c., and in every way a good substitute for Jute. It is also regarded as a fair substitute for Flax (Dict. Econ. Prod. Ind.). Samples sent to Kew in 1889 were valued at from £17–£18 per ton (Morris, Comm. Fib. Journ. Soc. Arts, 1895, p. 907). Samples that have been examined at the Imperial Institute, show that it contains over 75 per cent. of cellulose; has a staple of from 3–6 feet, and length of ultimate fibre 1·5–3·5 mm. The market value of the samples examined was given at approximately £17–£18 per ton (Bull. Imp. Inst. 1903, p. 24; 1908, p. 134).

This plant is believed to be the source of "Aramina" fibre, a comparatively new substitute for Jute in the manufacture of Coffee bags. These bags are considered especially valuable for the purpose, inasmuch as they have no influence on the aroma of the Coffee (De Wildeman, Pl. Util. Congo, Art. xvi. p. 205).

At the factory at Sao Paulo, Brazil, for the manufacture of goods from Aramina fibre; the price paid is about 1*d*. per lb. or about £9 10*s*. per ton (Cons. Rep. Ann. No. 2928, 1903, p. 11).

The bark is used in Yoruba to make ropes, and also as a tying material in house-building (Kew Bull. 1891, p. 212), similarly in Angola (Hiern, Cat. Welw. Afr. Pl. i. p. 67). The root, applied externally, is a remedy for rheumatism (Dict. Econ. Prod. Ind.).

The plant is used medicinally as a mucilage (Moloney, For. W. Afr. p. 282); and it has been mentioned as forage for cattle (De Wildeman, Pl. Util. Congo, Art. xxxi. p. 548).

The cultivation would in all probability be easy, on somewhat similar lines to those advised for *Abutilon indicum* or *Corchorus capsularis*. The plant is very common on waste ground, and on abandoned farms. Dr. Lester of the Gambia Delimitation Commission observed the plant growing in dry sandy soil, and in flat swampy country; common everywhere (Kew Bull. 1891, p. 269).

Ref.—"Aramina Fibre from the Carrapicho Plant of Brazil," in Bull. Imp. Inst. 1903, pp. 24–25; 1905, p. 262; 1907, pp. 9–10.

Urena sinuata, *Linn.*; Fl. Trop. Afr. I. p. 189 (*Urena lobata*).

Ill.—Rheede, Hort. Mal. x. t. 2; Burman, Thes. Zeyl. t. 69 f 2. (*Malvinda foliis*, &c.); Cav. Diss. t. 185, f. 2; Lam. Encycl. t. 583.

Vernac. name.—Rama (Nupe, *Dudgeon*).

Bida, N. Nigeria. Found throughout India.

Uses and cultivation as *Urena lobata*. Cultivated in the Niger districts for the sake of its fibre (Barter, Fl. Trop. Afr. i. p. 189).

HIBISCUS, Medik.

Hibiscus Abelmoschus, *Linn.*; Fl. Trop. Afr. I. p. 207.

Ill.—Rheede, Hort. Mal. ii. t. 38; Rumpf, Amb. iv. t. 15; Plenck, Ic. t. 543; Desc. Ant. v. t. 361; Blanco, Fl. Filip. t. 245.

Musk Mallow; Grains d'ambrette.

Cultivated throughout West Africa and most tropical countries.

Yields a strong fibre of good quality—percentage of cellulose approximately 78; length of staple 3–5 feet; length of ultimate fibre 3–4·5 mm. (Tech. Rep. and Sci. Papers, Imp. Inst. 1903, p. 68). The breaking strain of either wet or dry fibre has been estimated by Dr. Roxburgh at 107 lbs.

The present commercial value of the plant appears to lie in the aromatic seeds, which are used by perfumers to give a musky odour to satchets and hair powder (Mus. Kew). It is believed that the chief users of musk seed are the manufacturers of vermouth in France and Italy (Piesse, Agric. News, Barbados, 1904, p. 93). There is, however, not a large demand for the seeds; they are occasionally imported from the West Indies to London; from Java to Holland, and from Martinique to France, at prices varying from about 1*s.* to 2*s.* per lb.

Cultivation as *Hibiscus esculentus* (*q.v.*).

Ref.—Dict. Econ. Prod. Ind. iv. pp. 229–231.—Agric. Ledg. No. 6, 1896, pp. 29–31.—"Oil of Ambrette Seeds," in The Volatile Oils, Gildemeister & Hoffman, 1900, p. 501.—Tech. Rep. and Sci. Papers, Imp. Inst. 1903, pp. 68–69; with an analysis of the fibre from plants when in seed (retted for 13 days), and an analysis of fibre from stems cut when in flower (retted for 10 days).—"Musk Seed," Jackson, in Agric. News, Barbados, 1904, p. 93.

Hibiscus cannabinus, *Linn.*; Fl. Trop. Afr. I. p. 204.

Ill.—Roxb. Pl. Corom. t. 190; Rchb. Icon. Hort. Bot. t. 164; Duthie, Field Crops, t. 22.

Vernac. names.—Kanaff, Kanabe or Kanaspe (Persia, *Murray*); Wild Saur (Gambia, *Lester*); Ambari or Ambasi Hemp; Hemp-leaved Hibiscus; Deccan Hemp; Indian Hemp; Bastard Jute; Bimlipatam Jute.

Niger; Nupe; Lagos.

This is the most important fibre-producing Hibiscus in Nigeria. The fibre is understood to be as good as, and possibly superior to average Jute, for which it forms an efficient substitute in the manufacture of cordage, sacking, or any of the coarser textiles. Bleached materials made of this fibre may be dyed in every shade of colour, and chemical bleaching is said not to injure the texture (Kew Bull. Add. Ser. ii. p. 10). Cellulose percentage about 75; length of staple 3–7 feet; length of ultimate fibre 1·5–4 mm. (Tech. Rep. and Sci. Papers, Imp. Inst. 1903, p. 70; Bull. Imp. Inst. 1905, p. 260).

Bimlipatam Jute is identical with this fibre. This fibre has been a regular article of commerce since about 1901 (Tech. Rep. & Sci. Papers, Imp. Inst. 1903, p. 87). Its cultivation appears to be chiefly centred in the Madras Presidency, and the area under cultivation has been estimated at from 37,171 acres, producing 80,000 bales of fibre (in 1905), to 68,201 acres, with a production of fibre in proportion (in 1906) (U.S. Cons. Rep. Washington, May, 1907, p. 210). *Hibiscus cannabinus* is also cultivated in other parts of India, and, owing to the great similarity in the fibre, it is not unlikely that it often occurs as an adulterant of Jute *q.v.* for methods of preparation.

In 1891 the value of the fibre was estimated at about £18 per ton (Kew Bull. Add. Ser. ii. p. 10). In 1901 it was selling at £11–£12 per ton (Tech. Rep. & Sci. Papers, Imp. Inst. 1903, p. 87, Bimlipatam Jute); in 1906 at £18 12*s.* 6*d.* per ton (Mon. Circ. Ide & Christie, 15th June, 1906, Madras Jute.—Bimlipatam; and at the present time it is realising £12–£13 per ton (l.c. 15th Jan. 1909).

The seeds are said to contain 15–20 per cent. of a clear limpid oil, suitable for lubricating and illuminating purposes. In India the roasted seeds are eaten by the natives, and the young leaves are used as a pot-herb (Dict. Econ. Prod. Ind.). An infusion of the leaves is used on the Gambia as a remedy for coughs (Kew Bull. 1891, p. 269).

A rich, loose soil is the most suitable, but the plant has been described as doing well on dry lands, in red loams and gravels, and in marshes. The seed may be sown broadcast, fairly thickly, and thinned out to several inches according to evidence of development. For fibre production the plant requires about three or four months to come to maturity. The stems are usually cut at the flowering stage; but they are said to yield a stronger fibre when mature.

The yield per acre has been given as nearly 3 tons calculating 640,000 stems, each 100 stems producing one lb. of fibre (Dict. Econ. Prod. Ind.). Another estimate has been put at nearly 1½ tons per acre (Spon's Encycl. p. 961).

Ref.—Dict. Econ. Prod. Ind. iv., pp. 231–236.—Descr. Cat. Useful Fib. Pl. of the World, Dodge, Rep. No. 9, 1897, pp. 192–193, Fibre Investigations, U.S. Dept. of Agric.—"Kanaff or Deccan Hemp," in Kew Bull. Add. Ser. ii. 1901, pp. 9–11.—Agric. Ledg. No. 11, 1903, pp. 239–244.—Comm. Prod. Ind. Watt, 1908, pp. 630–631.

Hibiscus esculentus, *Linn.*; Fl. Trop. Afr. I. p. 207.

Ill.—Cav. Diss. t. 61 f. 2; Gilii & Xuarez, Rome, t. 3; Tuss. Ant. i. t. 10; Desc. Ant. iv. t. 269; Bentl. & Trim. Med. Pl. t. 36.

Vernac. names.—Kubaiwa or Kubewa (Hausa, *Dalziel*); Bendi-Kai; Ochro, Okra (W. Africa, W. Indies); Gobbo; Gumbo (S.United States); Quimbombo (Cuba).—Edible Hibiscus; Lady's Fingers.

Native of India; distributed over the whole of Tropical Africa; naturalized in all tropical and many sub-tropical countries.

The stem yields a good fibre, for particulars as to uses, preparation, &c., see the preceding species.

A sample, grown in Cuba, submitted to Kew in 1890, was valued in London at £18 to £20 per ton, described as moderately stronger than Jute (Kew Bull. Add. Ser. ii. p. 9), and a sample grown in S. Nigeria, recently submitted to the Imperial Institute, was valued at £18 per ton; described as white, lustrous, and rather harsh, the latter quality being due, it was suggested, to the plants being old (Bull. Imp. Inst. 1908, p. 128).

The young pods are used everywhere as a vegetable; they make good pickles and, being very mucilaginous, are largely used for thickening soups. The roasted seeds have been used as a substitute for coffee (Mus. Kew), and they are said to be used as a substitute for pearl barley. The mucilage of both fruits and seeds is used medicinally as a demulcent. The mature fruits form a constituent of curry. The leaves are recommended for cattle fodder, and the dried stalks as fuel (Dict. Econ. Prod. Ind.).

Under cultivation as a vegetable two varieties are distinguished —the long-fruited green and the round-fruited (Kew Bull. Add. Ser. ii. p. 8). The plant is cultivated in nearly every native garden or farm as a vegetable. When grown as a vegetable the young plants should have the tops pinched out when about a foot high. It takes from 5 to 10 lb. of seed to sow an acre, at intervals of about a foot, on ridges 3 feet apart, and the yield of fruit may vary from about 5,000 to 6,000 lbs. (Watt, Comm. Prod. Ind. p. 631). For cultivation as a fibre plant see the preceding species.

Ref.—Dict. Econ. Prod. iv. pp. 237–240.—Dodge, l.c. pp. 194–195.—Kew Bull. Add. Ser. ii. pp. 8–9.—Med. Pl. Bentl. and Trim. No. 36.—"Okra, Culture and Uses," Beattie, U.S. Dept. Agric. Farmers' Bull. 232, 1905, pp. 1–16.—"Fibres of British W. Africa," and "Jute Substitutes," in Bull. Imp. Inst. 1907, pp. 8–9; 1908, pp. 128–130.—Comm. Prod. Ind. Watt, 1908, pp. 631–632.

Hibiscus lunariifolius, *Willd.*; Fl. Trop. Afr. I. p. 202.

Ill.—Bot. Reg. t. 917 (*H. racemosus*); Wight, Ic. Pl Ind. or. i. t. 6.

Vernac. names.—Ramma or Rama (Kontagora, *Dalziel*).

Kontagora. Native of India; widely distributed in Africa.

Yields a good fibre, commercially described as Jute, hard and similar to that received from China, likely to sell freely at £12 to £13 per ton (Kew Bull. 1899, p. 139).

A sample of fibre believed to be obtained from this species was recently submitted to the Imperial Institute from N. Nigeria. It was valued at £12 per ton (with common Jute at £11–12), and described as of good lustre and strength; length 3–7 feet; capable of resisting the prolonged action of water; too harsh for use as a Jute substitute, but would make strong and durable ropes. The sample had the following composition:—Moisture 8·5 per cent.; ash ·4 per cent.; (*a*) hydrolysis (loss) 7·4 per cent.; (*b*) hydrolysis (loss) 10·2 per cent.; acid purification (loss) ·4 per cent.; cellulose 76·8 per cent.

Rama bark ribbons, six feet long, have been valued at £4 per ton, and the fibre in this condition is considered fit only for paper-making (Bull. Imp. Inst. 1908, p. 132).

For cultivation and preparation see *H. cannabinus.*

Hibiscus mutabilis, *Linn.* Sp. Pl. p. 694.

A small tree, without prickles. Leaves 2 in., nearly or quite glabrous; petiole short. Peduncle shorter than the petiole. Bracteoles 6–7, linear. Sepals ovate-lanceolate, longer than the bracteoles. Petals obovate, longer than the calyx. Anthers in whorls all the way up the column. Capsule oblong, obtuse, slightly hispid. Seeds pilose (Fl. Brit. Ind. i. p. 344).

Ill.—Rheede, Hort. Mal. vi. tt. 38–42 ; Rumpf, Amb. ix. t. 9 ; Andr. Rep. iv. t. 228 (Var. *fl. pleno*) ; Bot. Reg. t. 589 ; Desc. Ant. iv. t. 270 ; Savi. Fl. Ital. ii. t. 71.

The changeable Rose Hibiscus ; White Mahoe ; Changing Rose Mallow.

Native of China ; cultivated in the Botanic Gardens of the Colony.

The bark yields a strong fibre. Cellulose percentage 72, length of ultimate fibre 1·5 to 2·4 mm. (Tech. Rep. & Sci. Papers, Imp. Inst. 1903, p. 93, *q.v.* for complete analysis).

Propagation, from cuttings ; grows freely in rich soil ; the plant is very ornamental, and is remarkable for the changes in the colour of the flowers—from white in the morning to red in the evening.

Hibiscus physaloides, *Guill. et Perr.* ; Fl. Trop. Afr. I. p. 199.

Ill.—Wood, Nat. Pl. iv. t. 319.

Vernac names.—Akese or Ake, Wongo (Yoruba, *Higginson*).

Lagos.

Yields a fibre described as short and white (Higginson, Herb. Kew).

Hibiscus Rosa-sinensis, *Linn.* Sp. Pl. p. 694.

An ornamental shrub ; 6 to 10 feet high. Stem woody, branched, not prickly. Leaves entire at the base, coarsely toothed at the apex. Stipules ensiform. Bracteoles 6, 7, linear, half the length of the bell-shaped calyx. Sepals $\frac{3}{4}$ in., lanceolate, connate below the middle. Corolla 3 in. diam., red. Capsule rounded, many seeded (Fl. Brit. Ind. i. p. 344).

Ill.—Rheede, Hort. Mal. ii. t. 17 (double flower), vi. t. 43 (single flower). Bot. Mag. t. 158 ; Bot. Reg. t. 1826 ; Gard. Chron. Oct. 29th, 1887, p. 529, f. 105.

Shoe-flower.

Native of China ; cultivated in the Botanic Gardens, in most private gardens, belonging to Europeans, and in many native gardens of Nigeria.

In India and China the petals are used to blacken shoes (hence perhaps the English name), and the Chinese also make from them a black dye for darkening their hair and eyebrows. Various medicinal uses are attributed to the flowers and leaves, and the bark is said to yield a good fibre (Dict. Econ. Prod. Ind.).

Propagation, by cuttings. It is unusual for seeds to ripen under cultivation, but the several handsome varieties show that seeds may ripen under suitable conditions.

Ref.—Journ. Bomb. Nat. Hist. Soc. 1892–3, pp. 512–515.

Hibiscus rostellatus, *Guill. et Perr.* ; Fl. Trop. Afr. I. p. 201.

Vernac name.—Darwaso (Gambia, Bull. Imp. Inst. 1907, p. 459).

Ebute Metta.

Yields a jute-like fibre (Col. Rep. Ann. No. 576, 1908, p. 28).

Hibiscus Sabdariffa, *Linn.;* Fl. Trop. Afr. I. p. 204.

Ill.—Cav. Diss. t. 198 f. 1; Bonpland, Pl. Rar. Malm. t. 29; Desc. Ant. i. t. 31; Herb. Amat. v. t. 296; Drapiez, Herb. Amat. de Fleurs, v. t. 373; U.S. Dept. Agric. Farmers' Bull. 307, 1907, f. 1.

Vernac. names.—Tusure, Yakua (Hausa, *Dalziel*); Amukai or Isepa (Yoruba, *Higginson*); Masha (Beri-beri, Bull. Imp. Inst. 1907, p. 329); Sour-sour (Sierra Leone, *Haydon*); Rozelle or Red Sorrel (W. Indies).—Rozelle Hemp; Indian Sorrel.

Kontagora; cultivated in Trop. Africa and most tropical countries.

The stems yield a strong silky fibre, resembling Jute, suitable for gunny-bags, cordage, &c., and possibly for paper manufacture. Cellulose percentage 72, staple from 6–7 feet, length of ultimate fibre from 1·6 to 3·4 mm. (Tech. Rep. and Sci. Papers, Imp. Inst. 1903, p. 96). Preparation may be effected by ordinary retting and washing.

The leaves are used as a pot-herb for flavouring soup, &c., and are commonly sold in the markets. The seeds are good food for cattle (Mus. Kew), and are said to be aphrodisiac (Fl. Trop. Afr. i. p. 204). The fleshy calyces are made into preserves, and a refreshing beverage (Sorrel drink) may be made from them—prepared by boiling with water until they become pulpy, sweetening and spicing to taste. In the course of a day or so the clear fluid is strained off and bottled, and is ready for use after slight fermentation has occurred (Kew Bull. 1888, p. 203).

The leaves, seeds and ripe calyces possess antiscorbutic and other medicinal properties.

An infusion of the leaves and calyces has been recommended, amongst other agents of vegetable origin, as giving the best results for the coagulation of the latex of *Landolphia Heudelotii* (Warburg, Pl. Caoutch. 1902, p. 242).

An infusion of the leaves has also been recommended for the coagulation of the latex of *Landolphia owariensis* (Haydon, Rep. Bot. Stn. Sierra Leone, 1899).

Propagation from seed; the soil required is a rich sandy loam. To grow for fruit (calyces) the plants should be allowed a distance of about 4 feet; a bushy habit should be induced by pinching out the young tops occasionally. Plants come to maturity in about three or four months. For use as a vegetable in salads, &c., the leaves would be ready in about a month after germination. The plant, although it may succeed best in a moist climate, is well adapted to culture under irrigation, and would probably be suitable for cultivation in parts of Northern Nigeria, where the rainfall is uncertain and small.

Cultivation for fibre is the same as for *H. cannabinus*, *q.v.*

Ref.—Dict. Econ. Prod. Ind. iv. pp. 243–246, with chemical analysis of the fleshy calyx.—Descr. Cat. Useful Fib. Pl. of the World, Dodge, Rep. No. 9, 1897, p. 197, U.S. Dept. of Agric. Fiber Investigations.—Tech. Rep. and Sci. Papers, Imp. Inst. 1903, pp. 96–97, with an analysis of the fibre.—"Rozelle, Culture and

Uses," Wester, U.S. Dept. Agric. Farmers' Bulletin 307, 1907, pp. 1–6, figs. 6.

Hibiscus surattensis, *Linn.* ; Fl. Trop. Afr. I. p. 201.

Ill.—Rumpf, Amb. iv. t. 16 ; Cav. Diss. t. 53, f. 1 ; Bot. Mag. t. 1356 ; Rchb. Icon. Hort. Bot. t. 141 ; Wight, Ic. Pl. Ind. or. i. t. 197 ; Gard. Chron. April 25th, 1891, p. 529, f. 105 ; Wood, Nat. Pl. iv. t. 358.

Vernac. name.—Wongo (Lagos, *Dawodu* ; Oloke-Meji, *Foster*) ; Awon-Ekun (Yoruba, *Higginson*).

Old Calabar ; Lagos ; Oloke-Meji ; Brass.

Yields a good fibre (Mus. Kew). Leaves acid, eaten in salads (Loudon, Encycl. Pl. p. 587). A very handsome decorative plant, figured in Gardener's Chronicle (l.c.) from plants flowered at the Royal Botanic Gardens, Kew. Propagation by seeds or cuttings. Common in open dry places (Scott Elliot, Herb. Kew) ; open bush and Cassava fields (Bates, Herb. Kew).

Hibiscus tiliaceus, *Linn.* ; Fl. Trop. Afr. I. p. 207.

Ill.—Rumpf, Amb. ii. t. 73 ; Bot. Reg. t. 232 ; Tuss. Ant. ii. t. 5 ; Desc. Ant. ii. t. 148 ; Bedd. Fl. Sylv. (Anal. Gen.) t. 4, f. 1 ; Vidal, Fl. For. Filip. iv. t. 16 B ; Sinclair, Indig. Fl. Hawaiian Is. t. 1 ; Contr. U.S. Nat. Herb. ix. t. 61 (*Pariti tiliaceum*) ; Karst. & Schenck, veg. bild. iii. t. 42 ; Brandis, Ind. Trees, p. 75 ; Sim, For. Fl. Cape Col. t. 14.

Vernac. names.—Milolo (Luabo, *Kirk*) ; Umlolwa (Kaffir, *Sim*) ; Majagua (Panama, *Safford*) ; Fau (Samoa, Tahiti, *Safford*) ; Pago (Guam, *Safford*) ; Hau (Hawaia, *Sinclair*).—Corkwood ; Lime tree leaved Hibiscus.

Niger ; Brass. Widely distributed in the Tropics.

A useful fibre is obtained from this plant, a special feature of which appears to be its durability under water. Tarring is said to increase the strength. Suitable for making cordage, mats, &c., and a likely substitute for Jute. The bark is of some value medicinally ; the root possesses febrifugal properties, and is used in the preparation of embrocation. The wood is light, durable, and flexible. In Tahiti and Samoa it is said to be used for planking and in the construction of light boats (Safford, Pl. Guam, p. 347) ; in India its chief use is for fuel (Dict. Econ. Prod. Ind.).

This plant is propagated readily from seed. It will grow freely in low lying swampy ground. It is plentiful in the Sunderbuns of India, on the river banks of Burma, Ceylon, and is found near the coast-line of many tropical and sub-tropical countries in both the Old and the New World.

The cultivation should therefore be easy, and worthy of consideration in the delta of the Niger, where the plant already exists in a wild state ; Barter (Herb. Kew) found it growing 12 feet high on the sea shore at Brass. Sim (For. Fl. Cape Col. p. 143) mentions that the tree is largely planted in the streets of Durban, and that it grows to a height of from 20 to 30 feet.

Ref.—"*Pariti tiliaceum*," Safford, in Useful Plants of Guam, (Contr. U.S. Nat. Herb. ix. 1905) pp. 346–347.—Manson, in Indian Forester, 1905, pp. 347–350.

Hibiscus vitifolius, *Linn.*; Fl. Trop. Afr. I. p. 197.

Ic.—Rheede, Hort. Mal. vi. t. 46.

Vernac. name.—Ofo-odon (Yoruba, *Millson*).

Yoruba; Abeokuta; Jebba, and throughout Tropical Africa. Found also in India and Australia.

The bark affords a strong silvery fibre (Dict. Econ. Prod. Ind.). The plant, however, does not appear to be of any special value, but it may be worth recording as a handsome decorative plant, deserving more attention, for horticultural purposes.

The cultivation would probably present no difficulty. It grows on the roadsides, and in abandoned yam farms. Kurz describes it as common in India, along the borders of fields, in shrubberies, waste places around villages, &c., and in dry forests.

GOSSYPIUM, Linn.

Gossypium arboreum, *Linn.*; Fl. Trop. Afr. I. p. 211.

Ill.—Cav. Diss. t. 165; Royle, Ill. Him. Bot. t. 23, f. 2; Wight, Ic. Pl. Ind. or. i. t. 10; Todaro, Relaz. Cult. Cot. t. 1 A; Watt, Cotton Pl. tt. 7, 8.

Tree Cotton (India and Africa).

According to Watt there are many cultivated states of this species found all over India and Africa. The seeds have a greenish-grey fuzz, white silky floss, approaching khaki colour in wild plants.

Var. **neglecta**, *Watt*, Cotton Pl. (1907) p. 95.

Ill.—Rheede, Hort. Mal. i. t. 31 (*Alcea malabarensis*); Hill, Veg. Syst. xv. t. 19, f. 4 ((*G. hirsutum*); Roxb. Pl. Corom. iii. t. 269 (*G. herbaceum*); Royle, Ill. Him. Bot. t. 23, f. 1, Cotton Ind. tt. 2, 3, f. 1 (*G. indicum*); Parl. Sp. Cot. t. 1; Duthie, Field Crops, t. 18 (*G. herbaceum*); Engl. & Prantl. Pflan. iii. pt. 6, f. 25 (*G. aboreum*); Watt, Cotton Pl. tt. 10, 11, 12.

Cultivated in India, and Burma; distributed by cultivation to Africa, West Indies, &c.

The seeds are small, beaked, with a brownish or greenish fuzz and a large quantity of coarse, harsh, woolly and very short staple.

Var. **sanguinea**, *Watt*, Cotton Pl. (1907) p. 91.

Ill.—Jacq. Eclogae Pl. Rar. ii. t. 134 (*G. puniceum*); Todaro, Relaz. Cult. Cot. t. 1; Watt, Cotton Pl. t. 9.

Vernac. name.—Akese (Abeokuta, *Irving*).

Abeokuta (Irving, Herb. Kew); Lagos (Rowland, Herb. Kew); Niger (Baikie, Barter, Herb. Kew).

Seeds with grey or slightly greenish fuzz; staple long and of good quality.

Gossypium barbadense, *Linn.*; Fl. Trop. Afr. I. p. 210.

Ill.—Desc. Ant. iv. t. 278; Wight, Illust. t. 28 B; Royle, Cotton Ind. t. 3, f. 3; Parl. Sp. Cot. t. 3; Mart. Fl. Bras. xii. pt. 3, t. 114; Engl. & Prantl. Pflan. iii. pt. 6, f. 24 (after Parl. l. c.); Bentl. & Trimen, Med. Pl. t. 37; Watt, Cotton Pl. t. 46.

Ikure, S. Nigeria (Holland, Herb. Kew).

A perennial plant, but under cultivation it is usually treated as an annual. The seeds have no fuzz, and the lint, which is easily detached from them, is long, very fine, and silky.

In the report of the British Cotton-Growing Association for 1906–07 mention is made of an indigenous variety locally known as black-seeded, the cotton of which, purchased in the Benue and Guara districts, has been highly approved in the Lancashire trade.

Var. **maritima**, *Watt*, Cotton Pl. (1907) p. 275.

Ill.—Todaro, Relaz. Cult. Cot. t. 7 (*G. maritimum*), t. 8 (*G. maritimum*, var. *polycarpum*); Parl. Sp. Cot. t. 3 (*G. barbadense*); Tropenpfl. 1905, p. 175; Watt, Cotton Pl. tt. 46c, 47, 48.

Sea Island Cotton proper of commerce; Gallini Cotton (Egypt).

The chief sources of supply, which do not appear equal to the demand, are Georgia, Carolina, Egypt, West Indies, &c. Cultivated experimentally in Nigeria, and many other parts of Africa. This variety appears to be suitable for cultivation only in regions near the sea, 30 to 50 miles inland being considered approximately the limit of the successful area.

The seeds have no fuzz, and the cotton is easily detached; the staple (1½ to 2 inches) is the longest, strongest and, perhaps, the best in quality of all the cultivated forms of cotton.

Gossypium brasiliense, *Macf.* Fl. Jam. (1837) I. p. 72.

Ill.—Velloso, Fl. Flum. vii. t. 49 (*G. arboreum*); Parl. Sp. Cot. t. 4; Wight, Illust. t. 27 (*G. acuminatum*); Todaro, Relaz. Cult. Cot. t. 9, t. 12, f. 35; Watt, Cotton Pl. tt. 49, 50.

Chain Cotton; Kidney Cotton; Stone Cotton; Tree Cotton.

Lagos (Millen, Herb. Kew). Native of Brazil, from whence it comes into commerce as Bahia and Pernambuco Cotton. Cultivated in many parts of the tropics of both hemispheres.

The seeds are tufted with a reddish fuzz, but are otherwise naked. The lint is plentiful and usually very fine and silky.

Gossypium herbaceum, *Linn.* Fl. Trop. Afr. I. p. 211.

Ill.—Parl. Sp. Cot. t. 2; Engl. & Prantl, Pflan. iii. pt. 6, f. 22 (after Parl. l. c.); Watt, Cotton Pl. tt. 24, 25.

The source of the Syrian, Levant, Maltese, Arabian, some of the short staple American Cottons, and possibly of Abyssinian and some of the Egyptian Cotton.

Seeds with a grey fuzz, and harsh greyish-white lint. The plant is an annual, and does not appear to be known except under cultivation.

Gossypium hirsutum, *Linn.* Sp. Pl. ed. 2 (1763) II. p. 975.

[*G. herbaceum*, Oliv. Fl. Trop. Afr. i. p. 211, in part.]

Ill.—Nov. Comm. Gott. vii. t. 1 (*G. latifolium*); Wight, Illust. t. 28 C (*G. barbadense*); Royle, Cotton Ind. t. 3, f. 4; Parl. Sp. Cot. t. 5; Engl. & Prantl, Pflan. iii. pt. 6, f. 23 (after Parl. l.c.); Watt, Cotton, Pl. tt. 29, 30, 31.

Vernac. name.—Tonje-manga (Zambesi, *Kirk*).—Short Staple American (New Orleans and Georgian) ; American Upland Cotton.

Seeds with a greyish, rusty or green fuzz, and yielding a fibre of good quality.

Gossypium mexicanum, *Tod.* Relaz. Cult. Cot. (1877) p. 193.

Ill.—Todaro, l.c. tt. 7, 11, f. 32 ; Watt, Cotton Pl. tt. 39, 40.

Mexican Cotton ; Upland American.

Niger (Barter, Herb. Kew). Probably native of Mexico ; cultivated in many countries, in many varieties (*see* Burkett & Poe, "Cotton" ; True, "The Cotton Plant" ; Watt, in "Cotton Plants of the World"). Described on Barter's specimen, No. 1184, as ordinary cultivated kind.

The seeds are covered with a fuzz of various shades of colour, affording an ample quantity of lint.

Gossypium Nanking, *Meyen*, Reise, (1836) II. p. 323.

Ill.—Cav. Diss. t. 169 (*G. indicum*) ; Todaro, Relaz. Cult. Cot. t. 3, f. 1 (*G. indicum*) ; Watt, Cotton Pl. t. 15.

Nankin Cotton ; Chinese Cotton ; Siam Cotton ; Khaki Cotton. Cultivated in Africa and Asia.

Seeds covered with a rusty fuzz lint silky, of a more or less reddish colour.

Var. **Bani,** *Watt*, Cotton Pl. p. 131 ; an annual plant known only under cultivation ; furnishing a high-grade staple.

Var. **Nadam,** *Watt*, l. c. p. 128 ; a perennial plant, yielding a low-grade staple.

Var. **Roji,** *Watt*, l.c. p. 134 ; a perennial bush ; staple short and harsh.

Var. **soudanensis,** *Watt*, l. c. p. 138 ; a large perennial bush, furnishing a fair quantity of harsh woolly floss.

These varieties are all recorded from Africa, and it is probable that they occur in Nigeria.

Gossypium obtusifolium, *Roxb.* Fl. Ind. (1832) III. p. 183.

Ill.—Watt, Cotton Pl. tt. 19, 20.

Vernac. names.—Mokho (Senegambia, *Henry*) ; Rimo (Senegal, *Henry*).

The source of the Surat, Broach, Kathiawar and Kumpta Cotton of India, and widely distributed in the East. Occurs in Upper Egypt and other parts of Africa.

The seeds have a rufous or greyish fuzz, and coarse reddish-white wool.

Var. **africana,** *Watt*, Cotton Pl. p. 153.

Ill.—Watt, l.c. t. 23.

Vernac. name.—Akese (Abeokuta, *Irving*).

Abeokuta (Irving, Herb. Kew) ; Nupe (Barter, Herb. Kew) ; Banks of Komadugu, Waube near Geidam, N. Bornu (Elliott, Herb. Kew).

Seeds with a white or grey fuzz ; lint ample and fine.

Var. **Wightiana**, *Watt*, l.c. p. 143. [*G. herbaceum*, Oliv. Fl. Trop. Afr. i. p. 211, in part].

Ill.—Todaro, Relaz. Cult. Cot. t. 4, ff. 1–9 (*G. Wightianum*); Wight, Ic. Pl. Ind. or. t. 9 (*G. herbaceum*); Watt, Cotton Pl. tt. 21, 22.

Seeds with a short greyish fuzz; staple long and good. Cultivated as an annual.

Gossypium microcarpum, *Tod.* Hort. Bot. Pan. (1876) I. p. 63.

Ill.—Todaro, l.c. t. 14, Relaz. Cult. Cot. t. 11, f. 16 (seed only); Watt, Cotton Pl. t. 36.

Red Peruvian Cotton.

Gold Coast (Johnson, Mus. Kew); recorded also from Mexico, Peru, Brazil, Malaya, &c.

The seeds have a rusty or greenish-brown fuzz. The plant according to Spruce (Cult. Cotton, Peru, pp. 63–4) is capable of producing nearly 50 per cent. of lint.

Gossypium peruvianum, *Cav.* Diss. (1785–90) p. 313.

[*G. barbadense*, Oliv. Fl. Trop. Afr. i. p. 210, in part.]

Ill.—Cav. Diss. t. 168; Watt, Cotton Pl. tt. 37, 38.

Vernac. names.—Owu (Abeokuta, *Irving*); Ukoko (Congo, *Burton*); Bazazula (Batoka, *Kirk*),—S. American; Peruvian or Andes Cotton; Egyptian Cotton (Ashmouni, Mitafifi, Zafiri, Abassi, Bahmieh or Bamia, &c.).

Abeokuta (Irving, Herb. Kew); Niger (Barter, Herb. Kew); Lagos. Widely distributed in Africa and other countries by cultivation.

Seeds with a fuzz varying in colour, grey, rufous, or greenish, yielding a good quantity of lint.

Gossypium punctatum, *Sch. et. Thon.* Beskr. Guin. Pl. (1827), pp. 309–10 [*G. barbadense*, Oliv. Fl. Trop. Afr. i. p. 210, in part.]

Ill.— Watt, Cotton Pl. tt. 27, 28.

Vernac. names.—N'Dargua (Senegambia, *Henry*); Lado (Senegal, *Henry*); Kota-Kota (Nyasaland, *Webb*); Hindi (Egypt, *Watt*).

Wild in Nigeria, Gold Coast, Senegal, Angola, America, and the West Indies.

Seeds with a fuzz, and white silky floss.

Var. **nigeria**, *Watt*, Cotton Pl. p. 170.

Ill.—Watt, l.c. tt. 27, 28 A.

Badagry (G. Don, Herb. Brit. Mus.); Kouka (Vogel, Herb. Kew). Found also in the Transvaal (Mus. Kew).

Seeds with white fuzz, and a good quantity of lint.

Gossypium vitifolium, *Lamk.* Encycl. Meth. Bot. (1786) ii. p. 135.

[*G. barbadense*, Oliv. Fl. Trop. Afr. i. p. 210, in part.]

Ill.—Rumpf, Amb. i. t. 13 (*G. latifolium*); Cav. Diss. t. 166; Bot. Reg. t. 84 (*G. barbadense*); Tuss. Ant. ii. t. 17 (*G. tricuspidatum*); Watt, Cotton Pl. tt. 1, 45.

Kidney Cotton (Sittam, Ashantee, *Dudgeon*); Black-seeded Cotton (Labolabo, *Dudgeon*).—Vine-leaved Cotton.

Probably native of S. America; distributed by cultivation to Africa, S. United States of America, West Indies, &c.

Seeds without a fuzz, that is, black naked; lint long and silky, readily detached.

It is difficult to distinguish between this species and *G. barbadense*, with which it is regarded as identical.

They are separated by Watt (l. c. p. 266) on industrial rather than on botanical grounds, and as this authority has been followed in the other species and varieties enumerated *G. vitifolium* and *G. barbadense* are maintained as distinct species.

As a rule botanical delimitations are rarely recognized in cultivation, and the numerous hybrids and varieties are usually classified by cotton growers without reference to parentage.

Indigenous cottons of Nigeria have been spoken of as "black-seeded lowland" (cf. *G. barbadense* and *vitifolium*), and "woolly-seeded upland" (cf. *G. arboreum*, var. *sanguinea*; *G. mexicanum*; *G. obtusifolium*, var. *africana*; *G. peruvianum*; *G. punctatum*, var. *nigeria*). The black-seeded cotton has been stated to be better suited to the Lancashire trade than the upland white or woolly-seeded kinds which have been reported on by brokers as useful, and about equal to middling American (Brit. Cotton Assoc. Rep. 1906–07).

The essential conditions of cultivation and preparation appear to be careful selection of seed; a rich black, or alluvial well-drained soil; adequate rainfall (50–80 inches) or irrigation during growth; dry weather and clear skies during the opening period; good tillage and manuring up to the time when the bolls begin to form; careful picking, drying, ginning, and baling.

In Lagos, July is considered a good month for sowing (Brit. Cotton Assoc. Rep. No. 20, August, 1907). The seed should be disinfected beforehand, and the following method has been found successful in the West Indies.

"A wooden tub should be carefully washed out, and a solution of 1 in 1,000 corrosive sublimate made up in it. This should then be covered and allowed to stand. After a few days (say a week), when the reaction between the wood and the corrosive sublimate has finished, this solution should be run away, and a fresh supply made up by dissolving 1 oz. of corrosive sublimate to every 7 gallons of water. It is estimated that 1 gallon of the solution should be sufficient to disinfect 12 lb. of seed at a cost of a little more than 1c. The cotton seed is soaked in this solution for twenty minutes, then removed and spread in a thin layer, on a clean floor, or a clean canvas, to dry, either in the shade or in the sun. While drying, the seed should be turned several times, and when thoroughly dry it will be ready for planting, or may be put into bags and stored for some time. No seed should be planted without first being thoroughly dried. It is advisable to use a new solution for each new batch of seed.

"It has been shown that it is unnecessary to wash in pure water after soaking in corrosive sublimate if the seed is not to be kept for more than a few days before planting. If the seed is to be stored for any considerable length of time, it might be advisable to wash in pure water for ten minutes after taking from the disinfectant solution.

"The germination of the seeds, after disinfection for twenty minutes, would appear to be in no way affected, and, in some instances, germination has been somewhat hastened by the soaking." (Agric. News, Barbados, 1907, p. 183, reprinted in Kew Bull. 1907, p. 299).

Stationary gins of large capacity are more economical than small or portable gins. The bales should be carefully covered with a good quality gunny cloth, and distinctly marked and numbered ; the former to prevent loss in transit ; the latter to prevent confusion in different lots arriving by the same steamer. The size of the commercial bale varies considerably. The British Cotton Growing Association ensure that their bales weigh 400 lb., with a density of about 28 lbs. per cubic foot (Manchester Guardian, 8th June, 1907). For dock charges, *see Eriodendron orientale.*

The seed is a valuable product. When cotton first came into commerce the bulk of the seed was wasted, and some growers were so improvident as to disregard its value as a fertilizer. It yields on crushing a yellow oil largely used for soapmaking ; when refined, it is used in the manufacture of oleo-margarine, as a salad oil, and as a substitute for olive oil ; when bleached it is used in the preparation of a substitute for lard. The cake made from the seeds after the expression of the oil is a valuable feeding material for cattle, as also is the meal mixed with the hulls (about 20 per cent. of meal and 80 per cent. hulls). As a fertilizer the refuse, after the oil has been extracted, is of especial value, and wherever possible the oil should be expressed locally, in conjunction with the ginning and baling operations, and the refuse (meal and hulls) returned to the land either directly or indirectly as manure from stock fed on the material. It is not good husbandry to use the actual seed entirely for fertilizing because the oil has little or no manurial value, and would only be wasted, nor can the meal or hulls be effective without first being reduced to humus, either by exposure or, as already indicated, by feeding to stock. Machinery for crushing cotton seed was erected at Lagos in 1906 (Brit. Cotton Assoc. Rep. No. 16, 1906, p. 29) and may be expected to exercise an important influence on the industry.

The growing of other crops (catch crops) with cotton is perhaps not a good practice, but rotation crops are essential.

Ratooning, or treating cotton as a perennial, is not likely to be satisfactory. The plants being very liable to fungous diseases and insect pests, the ground ought to be thoroughly cleared after each crop in order to reduce the risk of disease as much as possible.

The cultivation of cotton in Nigeria, under the supervision of Europeans, has received attention for many years. In 1841 (*see* p. 34) experiments were undertaken, though with little success, near the confluence of the Benue and the Niger. In 1856 it is recorded that more than 100,000 lbs. of seeded cotton were sent from Abeokuta to Manchester, where it sold at 6*d.* per lb. Prior to this it was not considered worthy of the notice of European merchants ; the natives for want of proper machinery could not prepare it satisfactorily for the European markets. Accordingly gins and presses were sent out to Abeokuta, and the natives were encouraged to collect and prepare cotton for exportation. An Industrial Institution was established at Abeokuta by the aid of the Native Agency Committee (established 1845) in conjunction with the Church Missionary Society. The establishment was conducted by two native young men who had been instructed in England, one of whom had spent eighteen months in a Manchester cotton mill. Any native was allowed to send cotton or other produce to be prepared for the European markets (Rev. H. Venn, Memo. Encouragement of Native Agriculture, Dec. 1856). In 1857, 1,250 bales were bought from the natives of Abeokuta for the English market, the rate of purchase being ½*d.* per lb. in the seed. In the same year it was reported that from 1,000 to 2,000 packages of from 70–80 lbs. each were offered for sale at Ila near Ilorin on large market days (about every 4th day), for use in the manufacture of native cloth (Dr. Baikie, Jebba, 12th Dec. 1857, to the Sec. of State for Foreign Affairs). According to MacGregor Laird (Memo. Assoc. Cent. Africa Co. Ltd., 10th April, 1858) the cotton country of Central Africa, extending from Lake Chad to within 50 miles of the Bight of Benin, then produced large quantities for local use, but little for export, owing to the expense of land carriage for so bulky an article.

In 1869 the cotton exported amounted in value to £76,957, and the exports for ten years following, gradually went down to £526 (in 1879). The principal supply came from the Egba country (Col. Rep. Ann. No. 400, 1902, Agric. Lagos). In 1889 the Royal Niger Company were growing cotton at Abutshi, and Mr. Woodruff reported that it would do well there on good soil, but only one crop could be obtained in a year ; the plants then growing (Nov. 30th) were flowering. In 1890 the Director of the Royal Botanic Gardens, Kew, sent to Lagos a supply of Egyptian Cotton, the varieties "Ashmouni" and "Bahmieh" (cf. *G. peruvianum*). Particulars of this attempt to revive the industry are given in the Kew Bulletin (Add. Ser. ii. pp. 11–19). In 1902 he had occasion to urge that the most effective method of dealing with the cotton problem was to secure the temporary services of an expert from Egypt or America. About the end of the same year, through the interest of Messrs. Elder, Dempster & Co., an expert was appointed to S. Nigeria, and since that period the British Cotton Growing Association have established plantations and ginning centres in various parts of the two colonies (*see* also Bull. Imp. Inst. 1904, p. 13). The production for export has, accordingly, within the course of the past few years, expanded yearly from £150 in 1902 (Brit. Cotton Assoc. Rep. No. 16, 1906, p. 26), to £72,277 in 1906 (Govt. Gaz. S. Nigeria, 22nd. May, 1907, app. B. 1). In 1907 the value of the amount exported was £97,043 (11,147 bales, or 4,089,530 lbs.) Cotton seed to the value of £10,938 (93,820 bags, or 10,416,143 lbs.) was also exported (l.c. Feb. 19th, 1908, p. 319). The figures for 1906 and 1907 include the returns for N. Nigeria, where it is quite possible that up to the present time, considerably more cotton has been grown for local use than for export. It is in the Northern Colony that future expansion of the industry may be expected to occur; the climate and soil are eminently suitable, and when to these conditions are added the improvements in methods of cultivation, preparation and transport now in progress, there is reason to anticipate that it may eventually be an industry of great importance. The natural selection of the native cottons is likely to lead to greater success than the acclimatisation of exotic varieties, in both of which directions experiments are being conducted by the Botanical Department at Oloke-Meji, and other centres, and by the British Cotton Growing Association, on their plantations at Lagos, &c.

Under the Cotton Statistics Enactment of 1868, warehousers of cotton at all ports in the United Kingdom make periodical returns to the Board of Trade for general information. These statistics are published weekly in the Board's Journal. The returns issued on Jan. 2nd, 1908, show that 4,695,485 bales were imported into the United Kingdom during 1907, the greater proportion (3,565,816) being American, the remainder including Egyptian, East Indian, Brazilian, and British Colonies.

Statistics of the growing crop and final yield in the Cotton States of America are provided by the United States Department of Agriculture. From these guides abnormal states of the cotton market can therefore usually be traced to the excess, shortage, or absolute failure of some particular crop.

The Botanical, Agricultural, and Commercial aspects of the Cotton Industry have each been the subject of expert study and have led to an extensive literature, most of it readily accessible. The references now given may serve as guides to the more important contributions.

Ref.—"Gossypium barbadense" in Med. Pl. Bentley & Trimen, 1880, No. 37.—The Cotton Plant; Its History, Botany, Chemistry, Cultivation, Enemies, and Uses, prepared under the supervision of Dr. A. C. True, United States Dept. of Agriculture, Bulletin No. 33, 1896, pp. 1–433.—Kew Bulletin, Vegetable Fibres, Add. Series ii. 1901, pp. 11–27.—"Cotton"; containing information on Cultivation, Distribution, and Varieties of Sea Island; Improvement by Seed Selection; Agricultural Chemistry; Fungoid Diseases; Insect Pests, &c., in West Indian Bulletin, iv. No. 3, 1903, pp. 195–286 (Bowen & Sons, Bridgetown, Barbados, and Dulau & Co., London).—"Sea Island Cotton in the United States and the West Indies"; containing information on Mission to Cotton Districts of U.S. America; Sea Islands of South Carolina; Sea Island Cotton on James Island; Yield and Cost of Production; Cotton Ginneries in the United States and W. Indies; Recent Sales of West Indian Sea Island Cotton; Cotton-oil Factories; Treatment of Cotton Seed for feeding purposes, &c., in West Indian Bulletin iv. No. 4, 1904, pp. 287–374.—Report on the Habits of the Kelep or Guatemalan Cotton-Boll-Weevil Ant, Cook, Bureau of Entomology, U.S. Dept. of Agric. Bulletin No. 49, 1904, pp, 1–15.—Cotton Improvement, Sir G. Watt, in The West

India Committee Circular, April 23rd, 1904, pp. 139-158.—Prospects of Growing Cotton in the East Africa Protectorate, Brand, in Dip. & Cons. Rep. Misc. No. 606, 1904, pp. 1-10.—Le Coton dans l'Afrique Occidentale Française, Yves Henry; Bibliothèque d'Agriculture Coloniale Series, pp. 1–199 (Challamel, Paris, 1904).—Cotton Movement and Fluctuation, 1899–1904, 31st Annual Ed. pp. 176, with 6 plates (Latham, Alexander & Co., New York, 1904).—The Commercial Cotton Crops of 1900–1903, Watkins, U.S. Dept. of Agric. Bureau of Statistics, Bull. No. 28, 1904, pp. 1–83; including Statistics of the World's Cotton Spindles and Consumption; Cotton imported into Great Britain, 1895 to 1902; The World's Cotton Crop, 1865 to 1902, &c.—The Commercial Cotton Crop of 1903–1904, *Ibid*, Bull. No. 34, 1905, pp. 1–101.—"Cotton Growing in Northern Nigeria," in Bulletin, Imperial Institute, 1905, pp. 49-55.—"Fungoid Diseases of the Cotton Plant," l.c. pp. 60–62.—"Cotton Cultivation in the United States of America," dealing with Cotton Soils; Varieties of Cotton; Manures; Rotation Crops; Seed Selection; Systematic Production of Hybrids and the Prevention of Degeneration in standard types of Cotton; Insect and Fungoid Pests, with Preventive Measures; Egyptian Cotton in U.S.A.; Recent Improvement in Ginning and Baling, and Machinery for Picking, &c.; Dudgeon, l.c. 1905, pp. 334–345.—Cotton Cultivation, De Silva, 2nd Ed. Revised pp. 14, (Ferguson, Colombo, 1905).—"Cotton Improvement, W. African," in Bull. Imp. Inst. 1906, pp. 349–351.—Le Coton; A. Lalière, pp. 250; pls. 24, figs. 15; dgms. 2, one map (Challamel, Paris, 1906). Treating of the importance of raw cotton in the cotton industry; the culture and preparation—ginning, baling, &c.; the characters of the plant; uses of the fibre, seed and other products; the principal cotton growing countries, and the recent extension of cotton culture in various European Dependencies.—Cotton, Burkett and Poe (Doubleday, Page & Co., New York, and Constable & Co., London, 1906), 331 pages, 63 pages of illustrations, dealing with the Cultivation and Preparation; Cotton Seed, Oil, Meal and Hulls; Classification of Varieties; the Ills that Cotton is heir to; Insect Enemies; Marketing; Manufacture; and the Problems of the Cotton World, &c.—Cotton Seed and Cotton Cake Meal, Pamphlet No. 43, 1906, pp. 1–13, issued by the Commissioner, Imp. Dept. of Agric. W. Indies (Dulau & Co., London).—"Cotton," Mee & Willis, Roy. Bot. Gdn. Ceylon, Circ. No. 18, 1906, pp. 243–261.—Wild and Cultivated Cotton Plants of the World; a Revision of the Genus Gossypium, Sir George Watt; with 53 plates, 9 of which are coloured, pp. xiv. + 406 (Longmans, Green & Co., London, 1907). The work treats of the following subjects: History of the Cotton Plant and of the Cotton Industry; The Cotton Fibre; Species, Varieties, and Races of the Cotton Plant; Improvement of the Cotton Plant; African Cottons, are referred to in pp. 168–182.—A. B. C. of Cotton Planting; Pamphlet No. 45, 1907, pp. 1–98, issued by the Commissioner, Imperial Dept. of Agriculture for the West Indies (Dulau & Co., London). In 6 parts, dealing with the Cultivation; Insect Pests and their Treatment; Blights; Manuring; By-Products, &c.—Indian Cottons, Gammie, in Mem. Dept. Agric. India, ii. No. 2, 1907, pp. 1–23, pl. i–xiv.—"Cotton-growing in Algeria," in Bull. Imp. Inst. 1907, pp. 269–273.—"Studies of

Egyptian Cotton," Lawrence Balls in Year Book, Khedivial Agric. Soc. Cairo, 1907, pp. 91–111.—The Cotton Plant; its Development and Structure, and the Evolution and Structure of the Cotton Fibre, Flatters, pp. 112, with numerous plates (Sherratt and Hughes, London, and Manchester, 1907).—The Structure of the Cotton Fibre in its Relation to Technical Application, Bowman, pp. xx + 470, with many coloured and other illustrations (MacMillan & Co., London, 1908).—British Cotton Cultivation, Dunstan, Col. Rep. Misc. No. 50, 1908, pp. 1–46.—Indian Cotton Seed, Its Industrial Possibilities, Noel-Paton, Comm. Intellig. Agency, Calcutta, 1908, pp. 1–28.—Comm. Prod. India, Watt, pp. 569–624.—Reports of the British Cotton Growing Association, various.

ADANSONIA, Linn.

Adansonia digitata, *B. Juss.*; Fl. Trop. Afr. I. p. 212.

Ill.—Cav. Diss. t. 157; Lam. Encycl. t. 588; Tuss. Ant. iii. tt. 33, 34; Desc. Ant. iv. t. 291; Bot. Mag. tt. 2791, 2792; Rchb. Exot. v. t. 350; Belgique Hortic. ix. 1859, p. 76, f. 6 (tree), p. 79, f. 7 (fl. br.), p. 81, f. 8 (fruit); Bot. Centralb. lix. 1894, t. 1, f. 3 (fruit); Engl. Pflan. Ost. Afr. B, f. 16; Baillon, Hist. Madagas. t. 71 B, f. 3; Gard. Chron. Jan. 27th, 1900, p. 57; Sem. Hort. 1900, p. 29, f. 11; Ann. Inst. Col. Marseille, 1902, f. 1; Goetze & Engl. Vegetationsansichten Deut. Ost.-Afr. f. 4; De Wildeman, Pl. Util. Congo, t. 12; Pobéguin, Fl. Guin. Franç. t. 17; Transv. Agric. Journ. iv. t. 7, v. t. 169; Karst. & Schenck, veg. bild. v. t. 42.

Vernac. names.—Kuka (Kontagora, *Dalziel*); Oshe (Lagos, *Dawodu*); Nbondo, Imbondeiro (Angola, *Welwitsch*); Gongalasu (Khartoum, *Colville*).—Baobab; Sour Gourd; Cork Tree; Cream of Tartar Tree; Monkey Bread Tree; Maputa.

Niger; Idda; Nupe; Kontagora; Lagos; Old Calabar, and in all parts of the Colony. Native of Tropical Africa; common in India, and introduced to the West Indies.

The inner bark yields a strong useful fibre, used in Africa for making nets, rope, twine, sacking, and cloth (Mus. Kew). It is much used as a coarse textile and for various domestic purposes in Kontagora (Dalziel, Bull. Imp. Inst. 1907, p. 260). Sacking and wrappers made of this fibre are largely used in Angola for the conveyance of cotton, gum copal, and orchella weed (Cat. Welw. Afr. Pl. i. p. 80). In India it is used for making elephant saddles, &c. (Dict. Econ. Prod. Ind.). In England Maputa cloth was formerly used for paper making, chiefly strong packing papers; but its use for this purpose is now superseded by that of wood pulp (Bull. Imp. Inst. 1906, p. 277).

As a material for papermaking it is considered remarkable for its strength and toughness, the papers showing a resistance to tearing not unlike that of the Japanese papers (Hübner, in Journ. Soc. Arts, 1903, p. 837). Helmets, caps, and ladies' hats have also been made from this material (Mus. Kew). The trade in this fibre has always been somewhat limited. Supplies come chiefly from Portuguese West Africa, but the importations in 1896 amounted to only 2 tons; 190 tons were imported in 1887 (Dodge, Cat. Fib. Pl. p. 41). It comes occasionally into Liverpool in bales held together by hoop-iron (Hillier, Kew Bull. 1907, p. 63).

The method of preparation in Senegal is first to chop away the rough outer bark, strip off the inner bark in large sheets, thoroughly beat this to remove the pithy matter, dry the cleaned fibre in the sun, and press into bales (Spon's Encycl. p. 912). Welwitsch describes a somewhat similar method in Angola (Cat. Welw. Afr. Pl. i. p. 79).

The bark, medicinally, is an antiperiodic, and is regarded as a useful substitute for quinine. An ounce may be boiled in a pint to a pint and a half of water, and the whole taken in the course of a day (Dict. Econ. Prod. Ind.). The natives of the Umnyati River, S. Africa, use the bark like quinine in cases of fever (Baines, Mus. Kew). The leaves, powdered, are used as a condiment in soups and sauces, &c. (Barter, Mus. Kew). Medicinally they are astringent and prophylactic against fevers. A sample of the leaves from Sierra Leone has been examined at the Imperial Institute, and found to contain sodium chloride, potassium acid tartrate and tannin, to which constituents the medicinal value is doubtless due (Bull. Imp. Inst. 1906, p. 252).

The mucilaginous pulp of the fruit has a pleasant, somewhat acid taste, and makes a cooling drink in cases of fever. According to Heckel and Schlagdenhauffen it is successfully used by the natives as a remedy for dysentery, containing 12 per cent. of potassium bitartrate, and 2 per cent. of free tartaric acid, besides tannin, gum, mucilage, and glucose (Year Book, Pharm. 1889, p. 169). The pulp has also been examined at the Imperial Institute with a like result (Bull. Imp. Inst. 1906, p. 252). Various other medicinal uses in India and Africa are attributed to the fruit, including the seeds, which are stated to contain albuminous matter associated with 38 per cent. of fat (Year Book, Pharm. l.c.). The dried fruits are used for various domestic purposes, floats for fishing nets (Watt), pipes (Welwitsch), and water bottles (Baines).

The wood is light, soft, and porous, used like cork (De Wildeman), for canoes (Pobéguin), and provision boxes (Welwitsch).

Ref.—"Notice sur le Baobab," in La Belgique Horticole, ix. 1859, pp. 75-82.—Dict. Econ. Prod. Ind. i. 1889, pp. 105–107.—"Baobab ou Adansonia digitata," De Wildeman, in Pl. Util. du Congo, Art. xiii. pp. 156–163.—"A propos du Baobab," l.c. Art. xxiii. pp. 298–301.—"L'huile de Baobab," l.c. Art. xxxii. pp. 561–563.—"Etude sur la graine du Baobab," in L'Agric. pratique des pays chauds. iii. 1903–04, pp. 658-662.—"Leaves and Fruit of the Baobab Tree" (medicinal value) in Bull. Imp. Inst. 1906, p. 252.

BOMBAX, Linn.

Bombax buonopozense, *Beauv.* ; Fl. Trop. Afr. I. p. 213.

A deciduous tree, about 40 feet high. Leaflets obovate, abruptly acuminate. Calyx almost glabrous outside. Petals 2–2½ inches long. Stigmas diverging, not reflexed except at the apex.

Ill.—Pal. de Beauv. Fl. Ow. Ben. ii. t. 83, f. 1.

Vernac. names.—Eso, Pompola (Yoruba, *Millson*) ; Gurijia (Kontagora, *Dalziel*).—Silk Cotton Tree.

Yoruba ; Kontagora ; Nupe ; Borgu.

The fruits contain a silky fibre similar to Kapok (*Eriodendron anfractuosum*). The Yorubas use a decoction of the bark as an emmenagogue, and a powder made from the prickles mixed with oil as a remedy for "craw-craw":—a common skin disease (Millson, Kew Bull. 1891, p. 215). In Kontagora the bark is used mixed with tobacco flowers to improve the appearance of the teeth (Dalziel, Bull. Imp. Inst. 1907, p. 263).

The wood is soft and light, and is used by the natives of French Guinea for planks, doors, canoes, tom-toms, and household utensils (Pobéguin, Fl. Guin. Franç. p. 37).

Cultivation could probably be carried out on the same lines as that of *Eriodendron* (*q.v.*). The tree flowers in December and January (Elliott, Barter, Herb. Kew), before the end of the Harmattan (Dalziel, l.c.).

Bombax reflexum, *Sprague*, in Journ. Linn. Soc. xxxvii. p. 500; [*B. buonopozensis*, Hiern, Cat. Welw. Afr. Pl. i. p. 80, non Beauv.]

A deciduous tree, about 90–100 feet high; trunk 4–10 feet in diameter. Leaflets oblanceolate, acuminate. Calyx pubescent outside. Petals 2½–3 inches. Stigmas reflexed.

Vernac. name.—Obokha (Benin, *Unwin*):

Benin; known also from Uganda and Angola. Barter on his specimen (No. 731, Herb. Kew) drew a distinction between two trees: one 40 feet high, flowering in December (in Borgu and Nupe), and the other (which he did not collect) 100 feet high, flowering in April (at Onitsha). The latter may have been *B. reflexum*, and material of *Bombax* from Onitsha would be acceptable at Kew.

The general information given under *B. buonopozense* may apply to *B. reflexum*, although Unwin (No. 184, Mus. Kew) mentions that the tree is not used in the Benin district.

ERIODENDRON, DC.

Eriodendron orientale, *Steud.* Nomencl. Ed. 2, I. p. 587.

[*E. anfractuosum*, Mast. in Oliv. Fl. Trop. Afr. i. (1868), p. 214; *E. anfractuosum*, var. *indicum*, DC. Prodr. i. (1824), p. 479; var. *africanum*, l.c.; *Bombax pentandrum*, Linn. Sp. Pl. (1753), p. 959; *Ceiba Casearia*, Hiern, Cat. Welw. Afr. Pl. i. (1896), p. 80; *Ceiba pentandra*, Gaertn.; Engl. & Prantl, Pflan. iii. (1895), pt. 6, p. 63.]

Ill.—Rheede, Hort. Mal. iii. tt. 49–51; Rumpf, Amb. i. t. 80; Lam. Encycl. t. 851; Bot. Mag. t. 3360; Wight, Ic. Pl. Ind. or. ii. t. 400; Bedd. Fl. Sylv. (Anal. Gen.), t. 4, f. 2; Blanco, Fl. Filip. t. 238; Vidal, Fl. For. Filip. t. 17A; Greshoff, Nutt. Ind. Pl. t. 42; De Wildeman, Pl. Util. Congo, t. 29; L'Agric. prat. des pays chauds, 1905, p. 24 (group of trees), p. 27 (fruit), p. 33, f. 1 (fibre magnified); Pobéguin, Fl. Guin. Franç. t. 18; Brandis, Indian Trees, p. 77 (*E. anfractuosum*).

Vernac. names.—Eggun (Lagos, *Foster*, *Dawodu*); Okha (Benin, *Unwin*); Akbo (Ibo, *Thompson*); Rimi (Kontagora, *Dalziel*); Mafuma, Mafumeira; Suma-Uma (Angola, *Welwitsch*); Kapok (Dutch); Fromager (French Guinea).—Cotton Tree; White Silk Cotton.

Benin, Lagos, Kontagora, and widely distributed in West Tropical Africa ; found also in India, Ceylon, East Indies, &c.

The floss surrounding the seeds is an important commercial product. It is known generally as "Kapok," and used for stuffing cushions, pillows, mattresses, chairs, &c. It is now being used in the manufacture of lifebelts, lifebuoys, &c. It has also been suggested for use in medicine, in place of ordinary cotton (Pharm. Journ. [4] xix. p. 609). The fibre does not appear to be of use for textile purposes owing to shortness of staple and other mechanical defects which make it unsuitable for spinning, and to the low percentage of cellulose (Bull. Imp. Inst. 1905, p. 224). In a sample of Kapok from the Gold Coast the staple was from 0·8 inch to 1·1 inch long, and the diameter of the fibres 0·0006 to 0·0011 inch (l. c. 1908, p. 242).

The seed yields an edible oil, suitable for soapmaking, and cake made from the residue after crushing compares very favourably with ordinary cottonseed cake for feeding cattle. The ash of Kapok seed is considered a good manure, since it contains 28·5 per cent. of phosphoric acid and 24·6 per cent. of potash (Dict. Econ. Prod. Ind.).

The wood is light, about 30 lbs. per cubic foot. It is used in parts of Nigeria for making canoes and various domestic utensils, and for similar purposes in Angola (Welwitsch), French Guinea (Pobéguin), and the Congo (De Wildeman). A few years ago (1900) the Government of Lagos sent to the Royal Gardens, Kew, some samples of wood for report as to its value in the manufacture of paper, and as bottle wrappers. As a paper-making material the wood was reported on by Mr. Quirin Wirtz, Consulting Chemist to Messrs. John Dickinson & Co., Ltd., Croxley Mills, Watford, who summarises his report as follows :—

"The pulp cannot be considered a very desirable product. Generally I come to the conclusion that the production of pulp from the 'Silk Cotton Tree' cannot be a commercial success ; 1st, on account of the quality of the fibre ; 2nd, owing to the large expenditure in soda and bleach, and the hard boiling necessary ; 3rd, owing to the bad yield of fibres" (Director, Royal Gardens, Kew, to Colonial Office, Sept. 6th, 1900). For use as bottle-wrappers, it was considered that there was little chance of successful competition with straw (l. c.).

In India the wood is stated to be used for tanning leather, and from the bark a medicinal gum is obtained (Watt, Comm. Prod. Ind. p. 522). The leaves are sometimes used as a substitute for Ochro (*Hibiscus esculentus*) (Moloney, For. W. Afr. p. 286).

The cultivation of Kapok in the Dutch East Indies is carried on in regular plantations, or by planting along the road-sides. Propagation is effected by seed and by cuttings. The plants are usually put out at distances of 18 feet, and increase by cuttings is preferred as the plants yield a quicker return (Kapok, by J. C. Klütgen, Rotterdam, 1883). Propagation by seed has been found to be cheap and effective in the Philippine Islands for planting on a large scale. Trees raised from seed, when 20 months old, were over 6 metres in height and 40 centimetres in girth at 30 centimetres from the ground (Philippine Agric. Review, Jan. 1908, p. 40).

In Mysore the tree is grown from cuttings, as a support for the betel vine in Areca plantations (Gamble, Man. Ind. Timb. p. 92). The plants begin to bear fruit at the age of 2 years, and at the age of 5 years each tree may give about 300 fruits, capable of yielding 1·500 kilog. of Kapok. For a fully developed tree as much as 5,000 fruits may be expected, each yielding 4–5 grammes of cotton, or from 20–25 kilog. in all (De Wildeman, Pl. Util. Congo, Art. xxxiii. p. 566). Klütgen (l. c.) gives the number of fruits yielded by one tree yearly as 1,500, producing 22 per cent. of pure Kapok, 29 per cent. of seeds, and 49 per cent. of waste.

The pods ought to be gathered just as they are about to burst, and, as with cotton, careful picking, drying, ginning and baling is essential. The trees in Nigeria are somewhat scattered and usually occur in association with other trees. It is possible, therefore, that the collection of the bolls would be one of some difficulty, and at times impossible in any quantity, much less on a commercial scale. Under systematic cultivation, however, these difficulties would be removed.

Ginning is done largely by machinery, in Java, and to a certain extent by hand. When baling it is not advisable to press so tightly as in the case of cotton. Hydraulic or steam-press packing is liable to damage the fibre, and to destroy its elasticity. A "Silk Cotton Press," constructed by Stork & Co., has been found satisfactory. A bale of Java Kapok weighs about 80 lb.; Ceylon 200 lb., and a bale of Indian about 400 lb. The lighter bales realise the best price (Kew Bull. 1896, pp. 205 and 206).

The Dutch East Indies have always been the chief source of Kapok, the trade having commenced about 1877. Ceylon and India have also contributed to the trade, although the Indian product is more often that of Simul (*Bombax malabaricum*). The exports from Java and Madura during 1904 amounted to 77,464 bales, in 1905 to 56,377 bales, and in 1906 to 47,678 bales; early and excessive rains were stated to be the cause in some measure for the reduction in the 1906 crop (Dip. & Cons. Rep. Ann. No. 3820, 1907, pp. 7 and 20).

In 1896 Kapok was coming regularly into London to the extent of 100 bales a month from India and Ceylon, the value then being 2½*d.* to 4*d.* per lb. (Kew Bull. 1896, p. 207).

The dock charges on Kapok are: for landing, in bales, press or box packed, not exceeding 5 feet cube to the cwt., 4*s.* per ton; above 5 feet and not exceeding 12 feet, 6*s.* per ton; exceeding 12 feet or in bags or mats, 7*s.* 6*d.* per ton; for reweighing, repiling or rehousing, 1*s.* 6*d.*, 2*s.* 6*d.*, 3*s.* per ton; for delivery to land conveyance, 2*s.*, 2*s.* 9*d.*, 3*s.* 6*d.* per ton; for delivery to water conveyance, 3*s.*, 4*s.* 9*d.*, 5*s.* 6*d.* per ton; rent, 5*d.*, 6*d.*, 6*d.* per ton per week, respectively for the dimensions given above (Table of Rates, &c., London & India Docks Co. 1904, p. 36).

Ref.—Dict. Econ. Prod. Ind. iii. 1890, pp. 258–264.—Descr. Cat. Useful Fib. Pl. of the World, Dodge, U.S. Dept. of Agric. Fibre

Investig. Rep. No. 9, 1897, p. 160.—"Kapok," in Kew Bull. Add. Ser. ii. (1901), pp. 27–30.—"Kapok," in Pl. Util. Congo, 1903, Art. xxxiii. pp. 564–587.—"Kapok Fibre in Medicine," Pharm. Journ. [4] xix. p. 609.—"Vegetable Flosses or Silk Cottons," in Bull. Imp. Inst. 1905, pp. 222–225.—"Des Produits Utiles des Bombax et en particulier, du Kapok," Perrot, in L'Agric. Prat. des pays chauds, 1905, pp. 22–39.—Bull. Imp. Inst. 1907, pp. 120–121.—The Comm. Prod. India, Watt 1908, pp. 521–523.

STERCULIACEAE.

STERCULIA, Linn.

Sterculia cinerea, *Rich.*; Fl. Trop. Afr. I. p. 218.

Ill.—Rich. Tent. Fl. Abyss. t. 16; Engl. Monogr. Afr. Pflan. *Sterculiaceae*, t. 9, f. A.

Vernac. names.—Kookoomboya (S.W. Trop. Afr. *Baines*); M'loolooma (Madi, *Grant*); Tartar Tree (Soudan, *Broun*).

Strips of the bark from young plants are used as cordage, and the wood makes good poles for tents (Moloney, For. W. Afr. p. 287). The bark is used for a similar purpose in Madi and Bari, and the seeds are eaten during famine (Speke & Grant Exped. Journ. Linn. Soc. xxix. p. 38).

Sterculia rhinopetala, *K. Schum.* in Engl. Monogr. Afr. Pflan. *Sterculiaceae*, p. 102.

A tree, 80–100 ft. high, with a large dense head. Branchlets rather stout, tomentellous when young, soon becoming glabrous. Leaves entire, oblong-lanceolate or obovate-oblong, rounded or subcordate at the base, rounded obtuse, or subacute at the apex, 5–9 in. long, 2–4 in. broad, coriaceous, glabrous; petioles 1½–3 in. long. Calyx yellowish-green, ¼ in. long, lobed to below the middle, lobes appendiculate. Anthers arranged in two irregular rows. Seeds 7–12 in each follicle.

Lagos; the distribution extending to the Cameroons.

According to Zenker, the seeds are used like those of Cola by the natives at Yaunde in the Cameroons.

Sterculia tomentosa, *Guillem.* et *Perr.*; Fl. Trop. Afr. I. p. 217.

Ill.—Guillem. Perr. Rich. Fl. Senegamb. t. 16; Engl. Monogr. Afr. Pflan. *Sterculiaceae*, t. 9, f. G (androecium).

Vernac. name.—Chixe (Loanda, *Welwitsch*).

Niger; extending to S.W. Africa and the Soudan.

Very abundant in dry situations. The thick trunk yields a gum, like Gum Tragacanth; eaten as food by the natives of Loanda, in times of great famine (Hiern. Cat. Welw. Afr. Pl. i. p. 82).

Sterculia Tragacantha, *Lindl.*; Fl. Trop. Afr. I. p. 216.

Ill.—Bot. Reg. t. 1353; Engl. Monogr. Afr. Pflan. *Sterculiaceae*, t. 9, f. F.

Vernac. names.—Popripo (Benin, *Thompson*); Nespera or Nespera d'obo (St. Thomas, *Moller*); Quimdembia (Angola, *Welwitsch*).—African Tragacanth.

Yields a gum closely resembling Tragacanth (*Astragalus gummifer*), and often comes into commerce as an adulterant of Gum Arabic (*Acacia arabica* and *A. Senegal*). In French Guinea the roasted seeds are used as a medicine for stomach complaints, and the bark of the young branches is used as a tying material. The wood is used for planks, posts, and constructive work (Pobéguin, Fl. Guin. Franç. p. 74).

The specific gravity of the dry wood is 0·8. In St. Thomas the wood is sold at prices varying from 30 to 40 milreis (1*s.* 3*d.* to 1*s.* 8*d.* approx.) per cubic metre (Moller, Tropenpfl. 1902, p. 373).

FIRMIANA, Marsigli.

Firmiana Barteri, *K. Schum.* in Engl. & Prantl, Pflan. iii. pt. 6, 1895, p. 97.

[*Sterculia Barteri*, Mast. in Oliv. Fl. Trop. Afr. i. 1868, p. 218.]

Ill.—Hook. Ic. Pl. t. 2277 (*Sterculia Barteri*).

Vernac. name.—Eso or Esho (S. Nigeria, Bull. Imp. Inst. 1908, p. 316).

Yields a fibre, a sample of which, examined at the Imperial Institute, has been described as strong, harsh and woody, with a possible value of about £15 to £20 per ton, for ropemaking (Bull. Imp. Inst. l.c.). Rope made of the fibre is extensively employed by the natives for tying up bundles of Cola nuts (Col. Rep. Misc. No. 51, 1908, p. 62).

The wood is light, and used for fish-net floats (Barter, Herb. Kew).

COLA, Schott.

Cola acuminata, *Schott. & Endl.*; Fl. Trop. Afr. I. p. 220.

[*Cola vera*, K. Schum. *Sterculiaceae*, Afr. 1900, p. 125.]

Ill.—Pal. de Beauv. Fl. Ow. Ben. i. t. 24 (*Sterculia acuminata*); Karst. Fl. Columb. i. t. 69 (*Siphoniopsis monoica*); Bot. Mag. t. 5699; Heckel, Kolas Afr. p. 22 (group of trees), p. 24, and t. 1, ff. 1–7 (Cotyledons and their structure), t. 2 (young plant), t. 3, ff. 17–20; *Ibid* in Ann. Inst. Col. Marseille, 1893; Christy, New Comm. Pl. and Drugs, No. 3, 1880, p. 20 (*Sterculia acuminata*), No. 8, 1885, p. 5; Engl. & Prantl, Pflan. iii. pt. 6, f. 50 (after Karst. Fl. Columb.); Köhler, Med. Pflan. iii. tt. 19–20; Tropenpfl. 1900, p. 220 (*Cola vera*); Cat. Pl. Hort. Col. Brux. p. 67; Engl. Monogr. Afr. Pflan. *Sterculiaceae*, p. 126, f. 3 (after Karst, Fl. Columb.); Notizbl. Bot. Gart. Berl. iii. 1900, t. 1 A–F; Tropenpfl. 1904, p. 356, f. 3 (fruit of Gbanja-Kola); p. 363, f. 5 (tree of Gbanja-Kola, 2 years old); p. 365, f. 7 (tree of Abata-Kola, 5 years old); Pobéguin, Fl. Guin. Franc. t. 67; Karst. & Schenck, Veg. bild. iv. t. 30 (*Sterculia acuminata*).

Vernac. names.—Gonja (Foulah, *Barter*); Atara (Kabba, *Elliott*); Gbanjakola, Abatakola (Yoruba, *Bernegau*, *Dawodu*); Coleira (Angola, *De Wildeman*), Noix de Gouro (Ivory Coast, *Pobéguin*, *Köhler*, *Planchon & Collin*); Ombéné (*Planchon & Collin*, *Köhler*); Byssi (Jamaica, *Morris*).

S. Nigeria, all Provinces. N. Nigeria, Laboshi, Fashi, Yakudi, Gbaki, Patchiko, Kimbokum, Bete, Bitagi, Koda, &c.—Native of West Africa. Introduced to most tropical countries, and naturalized in the West Indies. From 1880 onwards the plant has been propagated at Kew and distributed to Botanic Gardens in those parts of the Empire where its cultivation is likely to meet with success (Kew Bull. 1890, p. 254).

The seed of this tree is the Kola nut of commerce. The nuts of some other species have also been used for the same purposes, viz., *Cola verticillata*, Stapf, *C. Johnsonii*, Stapf (Trop. Life, June, 1907, p. 84), *C. lepidota*, *C. anomala* (Year Book Pharm. 1900, p. 136), and *C. Ballayi* (Bull. Imp. Inst. 1903, p. 93). The seed of the true Kola may be usually distinguished by having only two divisions or cotyledons, whereas in other species there are generally more. Johnson has found two cotyledons in 68·18 per cent. of the seeds of *C. acuminata*; in 2·95 per cent. of those of *C. verticillata*, and in 6·97 per cent. of those of *C. Johnsonii* (Trop. Life, l.c.).

The Kola nut is used chiefly as a stimulant. It forms an important item in the daily life of the West African socially and dietetically. In Europe preparations of the nut are efficient substitutes for tea or coffee.

The seeds vary in colour, usually white or red, or sometimes an intermediate shade.

The Kola nut contains 2·348 per cent. of caffeine, 0·023 per cent. of theobromine, and 1·618 per cent. of tannin (Heckel, Kolas Afr. 1893, p. 206). The proportion of caffeine in samples examined at the Imperial Institute was found to be a little higher in the dry than in the fresh seeds; the different coloured seeds showed but little difference in the amount of caffeine present (Bull. Imp. Inst. 1907, p. 22).

Goris and Arnould have stated that the therapeutical value of fresh seeds is much superior to that of the dried seeds. They have proposed the following method of preparing a powdered Kola from the fresh seeds suitable for use in Pharmacy. The fresh seeds entire or separated into their cotyledons, are spread in thin layers on wire baskets; these are introduced into an autoclave previously heated to 100°; the temperature is then raised to 105°–110° for 5 to 10 minutes; the seeds are then taken out, cut into small pieces and dried either by exposure to the air or in a drying cupboard. White seeds remain white with the exception of a slight pink tinge on the surface, but red seeds turn violet. It is essential that the temperature of the seeds is rapidly raised from 15° to 100°. The powder thus obtained gave an excellent yield of Kolatin, and may be employed for the preparation of tablets, cachets, &c. (Pharm. Journ. [4] xxiv. 1907, p. 527).

Carles in 1900 suggested a process of beating the fresh nuts to pulp with an equal weight of lump sugar, by which it was maintained that all the constituents of the nut were preserved in an unaltered condition (l.c. p. 837). For export to countries outside Africa the nuts, after being skinned, are usually carefully and thoroughly dried; although to certain places, Brazil for instance, a trade in the fresh nuts has been developed (*see* Kew Bull. 1890, p. 258).

In West Africa the nuts are kept in as fresh a condition as possible. The seeds after being carefully removed from the husk and freed from the episperm, are carefully picked over, and a selection made of those only which are sound. They are then packed with moist "bal" leaves (*Cola cordifolia*), or packed with the leaves of *Thaumatococcus Danielli*, Benth. in broad baskets made of palm leaves (l.c. 1906, p. 91). To keep the seeds fresh it is necessary to pick them over, wash in fresh water and repack in fresh leaves about every 30 days (l.c. 1890, p. 256). For trade purposes the packages are constructed to contain about 3 cwt. of seeds, or 750 to 1000 kilog. (Tropenpfl. 1904, p. 353), and on board ship they are usually carried as deck cargo. For transport overland, other than by rail, the packages are considerably reduced in size, and are conveyed on pack-animals to Kano and other centres of trade in Nigeria, extending to Tripoli *via* Mursuk, and to Morocco *via* Timbuctoo. Fresh Kola nuts are imported into Tripoli *via* Marseilles, bought at the rate of 6 francs per kilog. (Tropenpfl. 1904, p. 357). The Hausas often barter salt for Kolas, the rate of exchange being 1 lb. of salt (value about 6*d.*) for 100 nuts (Kew Bull. 1906, p. 91). In Nupe white nuts realize about 2*s.* 3*d.* per 100, and red nuts 1*s.* 6*d.* to 1*s.* 9*d.* per 100 (Bernegau, Tropenpfl. 1904, p. 357). The price of fresh Kolas in countries of production may vary from 3*d.* to 1*s.* per 100, increasing in value according to the distance conveyed and cost of transport (Kew Bull. 1906, p. 91). In Bahia they are sold at 2*d.* to 3*d.* each according to freshness (l.c. 1890, p. 259). In the markets of Liverpool and London the dried nuts realize about 2½*d.* per lb.

The internal trade of Nigeria in these nuts is much greater than the external by sea. Lagos is probably the most important market for fresh nuts on the West Coast of Africa, and the imports for the year ending Dec. 31st, 1906, were 3,001,277 lbs., value £53,384, and for the same period into other Provinces of S. Nigeria, 3,729,815 lbs., value £59,074, whereas the exports from S. Nigeria for the same year were only valued at £3,716 (Govt. Gaz. S. Nigeria, May 22nd, 1907, App. A and B).

The Dock Charges in London for Kola nuts are: landing, 8*d.* per cwt.; reweighing, refilling or rehousing, 2½*d.* per cwt.; delivery to land conveyance, 4*d.* per cwt.; delivery to water conveyance, 6*d.* per cwt.; rent per week, ¾*d.* per cwt. (Rates and Charges, London and India Docks Co., 1904, p. 36).

The chief cultural requirements are a tropical climate, a rainfall of 50 inches and upwards, a deep, rich and well-drained soil, and moderate shade.

Plants may be propagated by seeds, which germinate in about a month, cuttings or layers. Young plants may be raised in nursery beds, but they do not transplant well, and it is best to establish them in bamboo pots until large enough to plant out in permanent places. They require to be planted at distances of from 20 to

30 feet, or wide enough apart to admit of shade trees being intermixed. Bananas make good shade in the early stages of growth, and later large trees such as *Albizzia Lebbek*, *Pithecolobium Saman*, &c., may be used. Trees raised from seed begin to bear a small amount of fruit when 5 or 6 years old, the produce increasing yearly until the tree matures. A tree planted in the Botanic Station, Lagos, in 1888, fruited for the first time in March, 1896 (Millen, Rep. Bot. St. 30th June, 1896). A remunerative crop may be expected after about 10 years, when it is stated that a single tree will yield an average of 120 lbs. annually (Kew Bull. 1890, p. 255).

In Yoruba the tree yields two crops, a large one from September to January, and a small one from May to August (Tropenpfl. 1904, p. 353).

According to Leigh and Dawodu the cultivation (of the Abata variety) is brought to a great state of perfection by the natives in the Ekiti country, where it is hilly and well covered with forests (Kew Bull. 1898, p. 139). In the Labogie district (Province of Nupe, N. Nigeria) Elliot states that the Kola plantations are situated in sheltered valleys at an elevation of from 450 to 550 feet above the sea. The soil is a deep black, sandy loam, kept in a continuous state of moisture by the streams that are found in each valley. Very little care is taken of the trees, and they are found growing with the Oil Palm (*Elaeis guineensis*). The rainfall of the district is probably between 40 and 50 in., but it is stated that no rain falls between December and April. The traders of the Soudan, according to Count Zech, prize the Kola from Labogie more than that from Ashanti (Kew Bull. 1906, p. 89).

The King of Nupe owns a plantation of 8 acres, and there is another large plantation at Agege containing 2,000 trees (*see* Tropenpfl. 1904, p. 357). Trees grow wild in the forests of Ilaro (Millen, Kew Bull. 1893, p. 183), and in the neighbourhood of Itele there are many fine trees planted by the natives (Millson, in Rep. Bot. St. Lagos, 30th Sept. 1890, App. B). They are grown largely in the districts of Warri and Benin (H. N. Thompson, to Director, Kew, 19th April, 1906), and are also grown at Great Bafum ; Takum is the Kola Market for all the Lower Benue States (Moseley, in Geog. Journ. xiv. 1899, p. 633).

It would seem that the cultivation of Kola in the Niger Region is of a comparatively recent date. Barter in 1859 stated that he had seen no living trees of "Gonja" (Foulah) the Kola with the two cotyledons, and understood that those he saw in trade came from Ashanti. A nut from which he raised a plant to send to the Royal Botanic Gardens, Kew, was obtained from a caravan at Rabba returning from the coast. He had observed the species with four cotyledons called "Fatak" by the Foulahs, and found that it was common in many parts of the Lower Niger, and abundant at Onitsha. The former realized in the Nupe Country 100 cowries each nut, and the latter about 80, the cowrie then being valued at the rate of 2,500 for the dollar at 4*s*. 4*d*. He mentions that immense quantities of Kola nuts were conveyed from the coast to the interior during the dry season ; about 1,000 donkeys monthly passing through Rabba, each laden with about 100 lbs. of nuts (Journ. Linn. Soc. iv. 1860, p. 18, Letter to Sir Wm. Hooker, dated Jan. 2nd. 1859).

Ref.—"Kola Nut Tree," in New Comm. Pl. and Drugs, Christy, No. 3, 1880, pp. 21–23; No. 8, 1885, pp. 5-14.—Kew Bull. 1890, pp. 253–260; "Synonymy of Cola acuminata" and the Labogie Cola, l.c. 1906, pp. 89–91.—"Les Kolas Africains,' Heckel, in Ann. Inst. Col. Marseille, 1893, pp. 1-406.—*Ibid*, Paris, 1893, Monographie botanique, chimique, thérapeutique et pharmacologique, &c.—"The Properties of the Kola Nut," in Journ. Soc. Arts, xliii. 1895, p. 831.—"Noix de Kola-Gourou-Ombéné-Nangoué," in Les Drogues Simples d'origine vegetale, Planchon & Collin, 1896, ii. pp. 715–720.—"Cola acuminata, R.Br." in Medizinal Pflanzen, Köhler, iii.—"Über die Stammpflanzer der Kolanufs," von K. Schumann, in Der Tropenpflanzer, 1900, pp. 219–223.—"Kola Nuts," Holmes, in Pharm. Journ. [4] x. pp. 665–666, Illustrated.—"Varieties of Kola Seeds," Pharm. Journ. [4] xvi. p. 266.—"Kola Nuts," in West Indian Bulletin, iv. No. 3, 1903, pp. 182–188.—"Studien Über die Kolanuss im Yorubalande," von L. Bernegau, in Der Tropenpfl. 1904, pp. 353–373, illustrated.—"Les Kolatiers et les Kolas," Jean Vuillet, in L'Agric. prat. pays chauds, vi. 1, 1906, pp. 129–136.—"Kola Seeds from the Gold Coast," in Bull. Imp. Inst. 1907, pp. 20–22, with analyses of red and white seeds.—"Kola in West Africa," S. Nigeria Govt. Gaz. July 21st, 1908, suppl. pp. vi.–viii.

DOMBEYA, Cav.

Dombeya Buettneri, *K. Schum.* in Engl. Jahrb. xv. p. 133.

A shrub, 7–15 ft. high, branchlets villous-hispid when young, afterwards becoming glabrous. Leaves suborbicular, more or less evidently 3–5 lobed, deeply cordate at the base, pubescent above, tomentellous or pubescent below, margin crenate-serrate; petiole 3–6 in. long. Cymes long-peduncled, dense-flowered; peduncle and pedicels hispid. Flowers about 1 in. in diameter, white with pink or reddish centre. Style 5-branched.

Ill.—Engl. Monogr. Afr. Pflan. *Sterculiaceae*, t. 2, f. B. a-f.

Vernac. name.—Ewe Ofo (S. Nigeria, Bull. Imp. Inst. 1908, p. 316).

Abeokuta (Irving, Herb. Kew).

A sample of the fibrous bark was recently submitted to the Imperial Institute. It was described as narrow brownish ribbons, harsh, woody and rather weak, which tended to break up on hackling; value £7 to £8 per ton (Bull. Imp. Inst. l.c.).

WALTHERIA, Linn.

Waltheria americana, *Linn.*; Fl. Trop. Afr. I. p. 235.

Ill.—Cav. Diss. t. 170 (*W. arborescens, microphylla*), t. 171 (*W. elliptica*); Sinclair, Indig. Fl. Hawaiian Is. t. 38; Engl. Monogr. Afr. Pflan. *Sterculiaceae*, t. 3, f. J.

Vernac. names.—Korikodi (Lagos, *Dawodu*); Hialoa (Hawaii, *Sinclair*).

This plant has been determined as being one of the ingredients of the "Agbo" pot, of the Lagos Hinterland (see *Xylopia aethiopica*). In Surinam it is employed as a febrifuge (Moloney, For. W. Africa, p. 287). The natives of Hawaii use the pounded leaves for filling the seams and cracks of their canoes (Sinclair, l.c.).

THEOBROMA, Linn.

Theobroma Cacao, *Linn.* Sp. Pl. ed. 1 (1753), p. 782.

A tree of medium size, 20 feet and upwards, branching trichotomously at or near the base; branches cylindric, bark smooth greyish or greyish-brown. Leaves alternate, entire, 8–9 inches long, 2½–3 in. broad, sometimes larger, ovate-lanceolate, or ovate-oblong, acute, somewhat rounded at the base; veins prominent beneath; petiole 1 inch or so long, thickened at both ends; stipules subulate-linear, acutely serrate. Flowers pale pink arising in clusters, or sometimes solitary, from the trunk and old wood of the branches, on slender, short pedicels. Fruit 5-celled, pendulous, solitary or grouped in twos or threes, corrugated, the furrows shallow, ridges blunt, usually numbering about 10, surface somewhat uneven, ovoid, oblate at the base, elongated towards the apex, major axis 6–7 inches, and the minor axis 3–4 inches; pericarp thick and firm, at first green, changing to yellow, and finally to red or purple. Seeds embedded in a sweet mucilaginous pulp, numerous, approximately 50 to 100 in each fruit according to the variety, slightly larger than almonds.

Ill.—Plenck, Ic. t. 578; Lam. Encycl. t. 635; Lodd. Bot. Cab. t. 545; Hayne, Darst. Beschr. Gewäsche, ix. t. 35; Guimpel, Abbild. Beschr. t. 75; Desc. Ant. iv. t. 266; Nees von Esenbeck, Plant. Medic. Düsseld. t. 419; Wagner, Pharm. Medic. Bot. t. 227; Spach, Suites, t. 25; Mitscherlich, Cacao, tt. 1, 2; Berg. & Schmidt, Darst. & Beschr. Pharm. tt. 33e, 33f; Nooten, Fl. Java, t. 1, t. 40 (var. *alba*); Bernouilli, *Theobroma*, tt. 1, 2; Bentl. & Trimen, Med. Pl. t. 38 (drawn from specimen flowered in the Royal Botanic Gardens, Kew; fruit from a specimen in the British Museum); Zippel, Ausl. Handels. Nährpflan. t. 3; Baillon, Dict. Bot. t. 30; Köhler, Med. Pflan. ii. tt. 157 i., 157 ii.; Sem. Hort. 1897, p. 317, f. 122 (tree in fruit); Preuss, Expedit. Cent. und Südamer. tt. 1, 2 (fruits, various forms); De Wildeman, Pl. Util. Congo, tt. 16–19; Gard. Chron. Aug. 15th, 1903, p. 115; Dec. 17th, 1904, p. 429 (fruit) Journ. Roy. Hort. Soc. xxviii. 1903, Proc. p. 44 (tree bearing fruit, grown at Norfolk House, Beulah Hill, Upper Norwood); Tropenpfl. 1904, tt. 9-12; Karst. & Schenck, Veg. bild. i. t. 14; L'Agric. prat. pays chauds, v. pp. 269–277; Contr. U.S. Nat. Herb. ix. t. 67.

Cocoa or Cacao; Chocolate.

Native of Tropical America; cultivated in Nigeria, and in many other Tropical countries.

The chief source of Commercial Cocoa may be attributed to this species and its varieties "*Criollo*" and "*Forastero.*"

Other sources, but to a smaller extent, are *Theobroma bicolor*, and *Theobroma pentagona.*

The uses of the Cacao bean in the preparation of chocolate and as a beverage are well known. The outer integument of the bean, supplied by the manufacturers of chocolate, is used in large quantities in Ireland for making a drink. These shells (so-called) are imported from Italy under the name of "Miserable" (Mus. Kew). The beans contain a high percentage of fat which is officinal (Oleum Theobromae) in the British Pharmacopoeia, and its use in Pharmacy is appreciated on account of its very slight tendency to rancidity. The fat has a bland agreeable taste; its specific gravity is 0·961, and melting point 20° to 30° C. (Watt, Comm. Prod. Ind. p. 1076).

Cacao has been under cultivation in Nigeria for some 20 years, and shipments have been made since about 1891. The cultivation was not taken up seriously under European supervision until the commencement of operations by the Royal Niger Company. Plantations were established at Abutshi and Onitsha in 1899 (Woodruff, Report, Nov. 1889), and in 1900 were taken over by the Government of S. Nigeria (*see* pp. 35–37). The plant has been cultivated at Lagos since the formation of the Botanic Station and distributed to various places in the colony. The work of distribution is now continued from Oloke-Meji. In 1895 it was reported that in the Lagos Colony much more attention seemed to be paid to the cultivation of Coffee than to that of Cocoa. A sample prepared on "Woodland" Estate, the property of Mr. J. P. L. Davis, then the largest and best plantation there, was valued at from 62*s*. to 65*s*. per cwt., with Ceylon at 70*s*. per cwt., and West Indian at 50*s*. to 52*s*. (Leigh, Report on Bot. St. Lagos, June, 1895). Cultivation and distribution was commenced at Old Calabar in 1893. In 1896 there were well-established plantations, belonging to the African Association at Eket (Quo Ibo), and Ikotombo on the Calabar River, and one plantation belonging to the Oil Rivers Company at Buguma (New Calabar). Of the plantations established by native chiefs may be mentioned one at Idua, the property of Chief Daniel Henshaw, and one at N'trukpom, near Isoninyan, the property of Prince Oyo Ita. The natives of Okenla, Egba, grow cocoa, and the region is considered an important one for the production (Punch, Lagos Govt. Gaz. Oct. 1902, p. 657).

The chief cultural requirements are a mean temperature of about 80° F., a rainfall of 50 inches and upwards; shelter from prevailing winds; rich, deep, well-drained soil, free from all chance of being inundated with salt water, and moderate shade at all stages.

The soil at Old Calabar, in which the trees grew well, is an alluvium, originally covered with thick bush and decayed vegetable matter, but too sandy to last without manuring. In Trinidad, a loose clay, or clay with an admixture of sand and lime, is considered suitable (Hart, Cacao, p. 1).

Propagation is usually effected by seed. The seed should be selected from the ripest and best developed fruits; they may be sown about 6 in. × 6 in. apart in nursery beds, and transplanted when about a foot to 18 inches high, and seeds are sown where the plants are to be permanent; about three seeds should be set a few inches apart, and the strongest plant only should be allowed to remain. Seeds may also be sown singly in bamboo pots, from which they can be readily transplanted when large enough into their permanent places.

In the island of St. Thomas, on the older estates, three seeds are planted in a Palm-leaf basket, and the plants are transplanted when they are from 2 to 3 feet high. On the more modern plantations the land is first prepared by cutting down the trees and brushwood, which are afterwards burnt. The seeds are then planted in the ground among bananas (Cons. Rep. Ann. No. 3928, Angola, Sept. 1907, p. 33).

It has always been a matter of some difficulty to convey seeds, except for very short distances, from place to place, and at the same time to preserve their germinating power. The usual method of distribution is by means of young plants in Wardian Cases. A method of conveying the seeds was recently tested at Kew and found successful. It consists of packing the seeds, from which the pulp has been for the most part removed, in material composed of equal parts of moist vegetable mould and finely ground or powdered charcoal (*see* Kew Bull. 1907, p. 297). For short distances, as a rule not extending over 10 or 14 days, seeds may be conveyed in the pods. It has been found, however, that seeds will germinate freely after being preserved in the pod for 17 days. In 1907 a consignment of 60 pods were sent from the Royal Botanic Gardens, Trinidad, to the Royal Botanic Gardens, Kew. They were despatched on the 24th June, 1907, and received at Kew on the 10th July. Nearly 100 per cent. of the seeds taken from clean pods germinated, and about 50 per cent. of those from pods which had gone mouldy.

Propagation by grafting has during the last few years been the subject of some experiments in various places. Hart (Trinidad) claims to have discovered in 1898 that Cacao can easily be grafted by approach or inarching. Jones (Dominica) finds that "Alligator Cacao" (*Theobroma pentagona*) united successfully on stocks of "Forastero," but that with stocks of "Tiger Cacao" (*Theobroma bicolor*) they were not successful. Evans (Gold Coast) reports the successful grafting of *T. pentagona* on to "Forastero" stocks (Report of the Bot. and Agric. Dept. Gold Coast, 1906, p. 10).

For purposes of shade in the early stages, plantains, bananas, maize, pigeon pea, cassava, castor oil, &c., might be used, and for permanent shade, the "Bois Immortel" (*Erythrina umbrosa*); *Erythrina lithosperma*; "Madera" (*Gliricidia maculata*)—used for this purpose in Nicaragua, planted from seed about 13 feet apart, and allowed to grow for 18 months or 2 years before the cocoa is put in (Agric. News, Barbados, 1904, p. 135); and Guango (*Pithecolobium Saman*), planted 50–63 feet apart (Bull. Dept. Agric., Jamaica, 1903, p. 121). Various rubber trees, &c., have also been recommended. Among indigenous trees the Oil Palm (*Elaeis guineensis*), "Opachala" (*Pentaclethra macrophylla*) "Nété" (*Parkia africana*) may be mentioned as being suitable for the purpose. Selection of the right plant, however, must be made according to local conditions. It may, in some localities, be found advisable to grow without shade. In Grenada this course has been attended with success (Proc. Agric. Soc. Trinidad, viii. 1908, p. 85).

Where manure is difficult or costly to procure it would be advisable to use plants or trees known to afford a supply of nitrogenous matter, often the one element of importance lacking in a tropical soil. Plants of approved value for green manuring are *Erythrina lithosperma*, *Albizzia moluccana*, *Phaseolus* spp., *Crotalaria striata*, *Arachis hypogaea* (ground nut), *Vigna Catiang* (cow pea), *Cajanus indicus* (pigeon pea), and various other leguminous plants.

The trees bear fruit on the old wood, and pruning should be very carefully attended to in the early stages, when all that is required can be done with a knife. The natural tendency of the tree is a trichotomous branching, and with this as a basis little difficulty should arise in controlling the development of a well-formed tree. An open centre, total height kept down to 15 or 20 feet for convenience in gathering and shading, free access of air and tempered light, are results specially to be desired. When the saw is called into requisition, as it may be occasionally, more especially for diseased branches, tar or some other convenient styptic should be applied after the cuts have been made clean and smooth with a sharp knife.

From the time of flowering the development and ripening of the pods occupies nearly six months. Collection is necessary at nearly all times of the year, the pods on each tree ripening at different times. Practical experience only will enable the cultivator to select those properly matured. Usually, the pods of good colour, and which sound hollow on a tap from the knuckle or knife handle, or in which the contents can be heard to move slightly when shaken, are in a fit state to be cut. Each pod ought to be removed singly, and cut with a sharp knife or "machete."

In Trinidad a special form of knife is used which enables the operator to separate the pod from the tree by an upward or side thrust (on a straight edge), or by a pull (on a nearly semicircular edge) (Mus. Kew). With a long shaft it is convenient for the removal of pods towards the top of the tree, but for those within easy reach an ordinary blade is considered the more convenient. Great care should be exercised to avoid injuring the wood of the stem at the point of attachment to the peduncle, as it is from near this place that the next batch of flowers will arise.

The collected pods are split open with as little delay as possible and the contents put at once to ferment in heaps, covered with banana trash, or in a receptacle—box, barrel or specially constructed tank—capable of containing not less than 500 lbs.

The object of the fermentation is to remove the mucilaginous matter, to destroy the vitality of the seeds, and to give the requisite colour—light brown or cinnamon in the case of "Criollo," and dark brown for "Forastero" (Hamel Smith in the Confectioners' Union, Jan. 15th, 1900)—flavour and aroma to the bean, and to procure the easy and fine "break" of a well-cured cocoa-bean. The ideal bean should have the shell a nice bright red, with a slight tendency to purple; "hardness of break," "flintiness," "soapiness," "grey colour," &c., all betoken insufficiency of ripeness and curing (l.c.). A blue fracture is said to give a bitter taste, and a brown fracture a sweet taste (Ann. Rep. Bot. Dept. Gold Coast, 1904). The process of fermentation may occupy from 3 to 10 days, according to the variety, the condition of the bean when gathered, and the season—dry or rainy. The temperature of the mass during fermentation should be kept approximately at 100° F. Due provision must be made in the fermenting receptacles for evaporation and the draining away of the acid liquor which is developed.

After fermentation the beans are washed and dried gradually on mats, trestles, or trays, either in the open or in well-ventilated sheds specially erected for the purpose. The drying process under favourable conditions should be accomplished in about a week.

Specially erected and permanent fermenting and drying houses become a necessity only where the produce is so great from large estates, as to create difficulty in meeting the exigencies of the weather during the period of preparation. Mid-day sun or rain are detrimental to the beans; the one is likely to parch or crack them, and the other is productive of mould.

A knowledge of the requirements will suggest the right kind of structure, having regard to the materials at hand, and in any case these need not be of a costly character.

In some countries, more especially in the Western Tropics, the beans are dried and cleaned after fermentation by "claying." This process consists of rubbing the beans with finely powdered red clay from day to day until all the mucilage is removed and they are quite dry and ready for shipment. In Trinidad this process is adopted on some of the best estates (Kew Bull. 1890, p. 172).

Much difference of opinion exists as to the value of these methods of washing and non-washing. In some parts of the West Indies the beans are in general neither washed nor rubbed; the mucilage is allowed to dry upon them after fermentation (Kew Bull. 1890, p. 172). In Ceylon the fermented mucilage is removed by washing, producing a clean bright sample free from discoloration of any kind (l.c.). It has been suggested that the natural aroma of Ceylon Cocoa is impaired by washing, and that the standard would be considerably raised if the Trinidad method of fermentation were applied (Trop. Agric. Ceylon, 1905, p. 248). Some experiments conducted recently at Peradeniya with a view to effecting a good curing of seeds fermented inside the pod, and also to obtain a clean marketable seed without washing, show that the results obtained did not justify any change in the method of preparation (Circ. No. 4, April, 1903, Roy. Bot. Gdn. Ceylon, pp. 68–69). Johnson, late Director of Agriculture, Gold Coast, recommended as the result of some enquiries that it would be more profitable to prepare the cocoa for market without washing.

Several samples of washed and unwashed Cocoa forwarded to the Royal Gardens, Kew, October, 1905, from the Gold Coast, were valued by Messrs. Lewis & Peat at from 48*s.* to 51*s.* per cwt. for the washed samples, and 47*s.* to 49*s.* per cwt. for unwashed ; they advocated washing. The samples had been fermented for periods varying from 4 to 8 days (Mus. Kew). In some samples the higher values were associated with the longer periods of fermentation (50*s.* to 51*s.*, 8 days) and in others with the shorter periods (50*s.*, 4 days), and on the whole the figures given were not such as to admit of an accurate conclusion being drawn as to the value of the fermentative period in conjunction with the washing (*see* Johnson to Director, Roy. Bot. Gardens, Kew, Aug. 16th, 1905, Gold Coast Bot. St. Records, 1862–1905, 313, and Bull. Imp. Inst. 1907, p. 361).

One fundamental argument in favour of unwashed beans is that they are heavier, and it would appear that, true as this axiom may be, it is open to question whether it is in all cases sufficient to compensate for the loss in quality and generally unsatisfactory appearance. Taking Ceylon as a typical producer of washed cocoa, and the West Indies for unwashed, we find the average price per lb. of the former for 1906 is 6·5 pence (4,455,901 lbs. valued at £122,729), and of the latter 6·125 pence (13,560,501 lbs. valued at £346,137) [Trade of the United Kingdom, 1907, p. 267, Imports], figures which show that there is much to be said in favour of both systems, more especially since Ceylon, which originally grew more "Criollo," now, according to authoritative reports, has a preponderance of "Forastero," a circumstance which brings the two sources more into line, and thus makes some approach to accuracy by comparison. The average price per lb. of Ecuador Cocoa for the same year was 7·25 pence (2,812,457 lbs. valued at £85,330) ; Venezuela 9·5 pence (127,625 lbs. valued at £5,144) in general non-washing countries ; B. W. Africa 4·175 pence (2,112,352 lbs. at £40,898) ; German West Africa 5·5 pence (242,051 lbs. at £5,484) [l.c.], perhaps chiefly if not entirely washed cocoas. These are facts which bear the same significance, and also indicate that factors other than washing must be taken into consideration ; which are, mainly, the variety grown, cultivation, the fermentative organisms, conditions under storage, and the condition of the market at the time of sale.

The trees begin to bear at their third or fourth year. At the sixth to ninth year they should be in fair bearing ; from the twelfth to the fifteenth year in their prime ; they may then be expected to yield remunerative returns for some fifty, eighty, or a hundred years (Morris, Cacao and How to Cure It, 1882, p. 36).

Hart gives 1·6 lb. per tree as a good yield, and as a poor yield 0·8 lb. per tree (Cacao, p. 73). He gives the remarkable record of 15 lbs. 9 oz. for one special tree during 1907 (Bull. Misc. Inf. Roy. Bot. Gardens, Trinidad, 1908, p. 20). It has been estimated that in Ecuador 4,827 plantations, with a total of 58,551,142 trees, yielded 41,134,900 lbs. (Consul-Gen. Dietrich, Guayaquil, U.S. Cons. Rep. May, 1907, p. 210) approximately, the poor yield above-mentioned taking the average per tree. Watt gives an estimate of 1–10 lbs. of dry nibs in a year (Comm. Prod. Ind. p. 1076). Various estimates are given by Wright (Cacao, p. 193) from 1–8 lbs.

The chief commercial sources of Cacao are Ecuador, Venezuela, Colombia, Mexico, Guatemala, Honduras, Brazil, Guiana, West Indies, Ceylon, Java, Gold Coast, Nigeria, Cameroons, and Portuguese Africa (St. Thomas, Principe, Angola). Ecuador is the largest producer. The total output of the World has been estimated (for 1906) at 151,000 metric tonnes (U.S. Cons. Rep. May, 1907, p. 211), equal to 61,094,600 lbs. The total amount of raw cocoa from all sources imported into the United Kingdom during 1906 was 51,670,321 lbs, value £1,335,107 (Trade of Unit. Kingdom, 1907, p. 267). In the same year the Western Province of Nigeria exported 1,153,439 lbs., value £20,893, and the Eastern and Central Provinces exported 466,548 lbs., value £6,151 (S. Nigeria Govt. Gaz. No. 26, May 22nd, 1907, Append. B i. and B ii.). This shows a marked increase on the returns for 1898, when the imports into the United Kingdom from the Niger Coast Protectorate were 139,220 lbs., value £2,980, and from Lagos 52,391 lbs., value £1,058.

The Dock Charges on Cocoa are: landing, 5*d.* per cwt.; weighing, repiling, or rehousing, 1½*d.* per cwt.; delivery to land conveyance, 3*d.* per cwt.; delivery to water conveyance, 4*d.* per cwt.; and for rent, 6*d.* per ton per week (Table of Rates, &c. London and India Docks Co. 1904, p. 22).

The literature on Cocoa is extensive, and the following list is representative of the more important works.

Ref.—Le Cacao et le Chocolate, Botanique, Chimique, Physiologique, Agricole, Commerciale, Industriel, et Economique, Mangin, pp. 1–331, Paris, 1860.—"Cocoa, Its Cultivation, Manufacture and Uses; Its Advantages and Value as an Article of Food," Mann, in Journ. Soc. Arts, viii. 1860, pp. 775–780, 785–790, 795–800, 805–810.—Cocoa, Its Growth and Culture, Manufacture and Modes of Preparation for the Table, Hewett, pp. 1–87 (E. & F. N. Spon, London, 1864).—"On Cocoa and Its Manufacture," Holm, in Journ. Soc. Arts, xxii. 1874, pp. 356–366.—"Oleum Cacao," in Pharmacographia, Fluckiger & Hanbury, pp. 95–97 (Macmillan & Co., London, 1879).—"Cocoa or Cacao," in Spon's Encyclopaedia, Div. ii. 1880, pp. 684–690.—*Theobroma Cacao*, in Medicinal Plants, Bentley & Trimen, No. 38 (J. & A. Churchill, London, 1880).—"Sur la Culture du Cacaoyer," Boussingault, in Journ. de Pharm. et de Chimie, July, 1883, pp. 20–24.—Cacao Planters' Manual, Bartelink, translation by H. J. Vogin, pp. 1–57 (Kirkland, Cope & Co., London, 1884).—Hints on Cocoa Planting, Tobago Agricultural Society, 1886, pp. 1–15.—Cacao, How to Grow and How to Cure It, Morris, Jamaica, pp. 1–42 (Aston, Gardner & Co., London, 1887).—"Cacao" in Tropical Agriculture, Nicholls, Dominica, pp. 110–122 (Macmillan & Co., London, 1892).—Cocoa: All About It, "Historicus," pp. 1–114, illustrated (Sampson Low, Marston & Co., London, 1892).—Kew Bulletin, "Cacao Cultivation in Ceylon," 1890, pp. 170–173; "Cacao Cultivation in Grenada," 1893, pp. 136–139; "Cacao Cultivation, Gold Coast," with cost of clearing, 1895, pp. 13, 22; "Cacao in Ecuador," 1899, pp. 42–45; "Cacao Disease in Trinidad," with Plate, 1899, p. 1.—*Theobroma Cacao*, in Dict. Econ. Prod. Ind. Watt, vi. part iv. 1893, pp. 43–45.—"Cacao

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No. 299, 1899, pp. 250–261, dealing with the Soil, Cultivation, Harvesting, Marketing, Cost of Production, Consumption, Uses, and Botany of Cacao as grown in Ecuador, with a table showing analyses of Cacao.—Hints on the Cultivation and Preparation of Cocoa, Johnson, pp. 1–15 (Silvanus Cole, Accra, 1899).—Le Cacaoyer, Jumelle, pp. 1–211, 19 figs; dealing with the Botany, Chemistry, Commerce, Culture, Insects and Diseases, and the Countries of Production (Challamel, Paris, 1900).—Cacao, A Treatise on the Cultivation and Curing, Hart, Trinidad, pp. 1–117, illustrated (Davidson & Todd, Trinidad; Wm. Wesley & Co., London, 1900).—"Cocoa, Cacao Fat, Chocolate," &c., in Bull. Misc. Information, Roy. Bot. 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TRIPLOCHITONACEAE.

TRIPLOCHITON, K. Schum.

Triplochiton Johnsonii, *C. H. Wright*, in Hook. Ic. Pl. t. 2758.

A tall soft-wooded tree. Leaves palmately 5-lobed, 5 in. long, 7½ in. wide, obtuse, cordate at the base, at first obscurely pilose above, quite glabrous beneath; lobes triangular-ovate; secondary nerves pinnate; reticulation fine; petiole 3 in. long, cymes axillary, about 20-flowered, shorter than the petioles. Calyx 5-partite, 7 lin. in diam. densely and appressedly brownish-silky on both surfaces; lobes ovate, acute, valvate, patent. Petals obcordate, broadly unguiculate, 7 lin. long and wide, pilose on both surfaces, white with a purplish base. Gynandrophore 1–2 lin. long, pubescent. Stamens about 20; filaments filiform, sometimes very shortly connate at the base ; anthers dorsifixed, oblong, curved, 2-celled, dehiscing by the rolling back from the centre of the cell-wall ; staminodes 5, broadly oval, concave, chaffy, quite glabrous, 1½ lin. long. Carpels 5, concealed by the staminodes, free, 1 lin. long, brownish-pubescent, style subulate ; ovules 4–6 on the ventral suture.

Ill.—Hook. Ic. Pl. t. 2758.

Vernac. names.—Owawa (Gold Coast, *Johnson*) ; Arere (Yoruba, *Foster*) ; Obeche (Benin, *Foster*).

Benin.

The wood, though soft, can be used for canoes, which, however, are not very lasting (For. Dept. S. Nigeria, Mus. Kew).

Triplochiton nigericum, *Sprague*, in Kew Bull. 1909, p. 212.

A deciduous tree. Leaves 7-lobed, 5–9 in. long, 6–10 in. wide ; lobes oblong ; petiole 2–3½ in. long. Stipules arcuate, ½–¾ in. long, with a terminal tuft of hairs. Stamens 40 or more. Otherwise like *T. Johnsonii.*

Vernac. name.—Arere (Ibadan, *Punch*).

Ibadan Forest Reserve ; Oloke-Meji ; Jebu-Ode.

Wood white, used to make large canoes, but which are not very durable. Flowers December to January, and stated to be the commonest tree in the Lagos Forest (Punch, Herb. Kew).

Triplochiton sp.

Tree up to 25 feet in girth.

Vernac. name.—Obeche (Cent. Province, *Unwin*).

Satin-wood.

A common tree in many localities.

A valuation of 2¾*d.* to 1*s.* per foot was given for a sample of this wood in the Liverpool market where it was classified as Satin-wood.

The tree grows on high land with a good soil (Kew Bull. 1908, p. 195).

TILIACEAE.

GREWIA, Linn.

Grewia bicolor, *Juss.*, Ann. Mus. iv. (1804), p. 90.

[*G. salvifolia*, Mast. in Fl. Trop. Afr. I. p. 247, not of Linn. f. nor of Heyne ex Roth.]

Ill.—Juss. l.c. t. 50, f. 2.

Nupe ; Senegambia and confined so far as is known to Western Tropical Africa. Drummond states that the Indian and Abyssinian plants that have been identified with it are distinct.

Fruits edible, though very small.

Grewia mollis, *Juss.*; Fl. Trop. Afr. I. p. 248.

Ill.—Trans. Linn. Soc. xxix. t. 17.

Vernac. name.—M'Koma (Cent. Africa, *Grant*).

Abo; Nupe; Mt. Patti, Lokoja. Distributed throughout Tropical Africa.

The mucilaginous bark is used in soups (Barter, Fl. Trop. Afr. l.c.). The fruit, about the size of a pea, is edible, and pleasant to taste. The wood is made into bows and arrows by the natives. The outer wood is yellow, and the heart is dark resembling rosewood (Grant, Trans. Linn. Soc. xxix. p. 40).

TRIUMFETTA, Linn.

Triumfetta cordifolia, *Guill. et Perr.* Fl. Sengamb. (1831), p. 92.

[*T. semitriloba*, Mast. in Fl. Trop. Afr. I. p. 256, non Jacq.]

Ill.—Guillem. Perr. Rich. Fl. Senegamb. t. 18.

Var. **Hollandii,** *Sprague*, Kew Bull. 1908, p. 232, differs from the type in having the stems and flower-buds hirsute, with long simple hairs.

Vernac. name.—Esura (Lagos, *Dawodu*).

Lagos; Abeokuta; Epe; Oloke-Meji, in the Western Province; Okuni, Eastern Province.

Used in Lagos as a fibre plant (Kew Bull. 1908, p. 232).

Samples of the fibre prepared on the Gold Coast, by the Cort Development Syndicate, Ltd., were valued, if clean and uniform in length and strength, at about £27 per ton (Kew Bull. 1906, p. 397, *Triumfetta semitriloba*, var. *africana*). The samples were prepared by retting, from 3 to 20 days. One sample had the bark scraped before retting (Mus. Kew).

Var. **typica,** *Sprague*, Kew Bull. 1908, p. 231.

Vernac. name.—Raka or Racca (Sierra Leone, *Cole*, *Dudgeon*).

Lagos.

Yields a fibre (l.c.).

Var. **tomentosa,** *Sprague*, Kew Bull. 1908, p. 232.

Vernac. name.—Quibosa (Golungo Alto, *Welwitsch*). The fibre is used in Angola for making ropes and sacks (Hiern. Cat. Welw. Afr. Pl. i. p. 97).

Triumfetta rhomboidea, *Jacq.*; Fl. Trop. Afr. I. p. 257.

Ill.—Jacq. Ic. t. 90; Bot. Reg. t. 1058 (*T. micropetala*); Queensland Agric. Journ. viii. 1901, p. 111, t. 8.

Vernac. name.—Ako-bolobolo (Lagos, *Dawodu*); Nesuwa (Yoruba, *Higginson*); Nzonogwi (Zomba, *McClounie*); Tsitiamoty (Madagascar, *Heckel*).—Chinese Burr.

Lagos; Yoruba; Nupe; Abokam; Ikum, and widely distributed in Tropical Africa.

The plant yields a soft glossy fibre (Dict. Econ. Prod. Ind.).

A sample from Nyasaland examined at the Imperial Institute shewed the following characters. The analysis of a sample of extra fine Indian Jute is given for comparison :—

	Triumfetta rhomboidea ("Nzonogwi").	"Extra Fine" Indian Jute.
Moisture per cent.	10·4	9·6
Ash, per cent.	0·6	0·6
a–Hydrolysis, loss per cent. ...	9·1	9·1
b–Hydrolysis „ „ ...	14·7	13·1
Mercerisation „ „ ...	8·5	8·5
Acid purification, loss per cent. ...	3·4	2·0
Nitration, gain per cent.	30·2	36·7
Cellulose, per cent.	76·2	77·7
Length of ultimate fibre ...	2·0–2·8 mm. 0·08–0·11 in.	1·5–3·0 mm. 0·06–0·12 in.

(Bull. Imp. Inst. 1905, p. 25.)

For spinning purposes the fibre is regarded as the same as that of *Sida rhombifolia* (*q.v.*).

For preparation of the fibre the stems are cut close to the ground and scraped with a knife in order to remove the smaller branches and the rough hairy epidermis. The bark is readily stripped from the stems, and the ribbons so obtained have an average length of 5½ feet. After these ribbons have been immersed in water for 14 days the fibre is easily separated from the pulp, then cleaned by washing, and afterwards dried by exposure to the sun for 24 to 48 hours (Bull. Imp. Inst. 1905, p. 23).

All the species belonging to this genus are mucilaginous and are used as demulcents, but this species is the one generally employed. The mucilage is said to make a serviceable injection for inveterate gonorrhœa. The burr-like fruit in India is believed to promote parturition. The plant is sometimes eaten as a pot-herb (Dict. Econ. Prod. Ind.). It is eaten by buffaloes (De Wildeman, Pl. Util. Congo, Art. xxxi. p. 548).

For particulars of cultivation see *Sida rhombifolia* and *Corchorus capsularis*. The plant is said to grow well on any marshy soil. It is one of the most troublesome weeds on the scrub lands of tropical Queensland (Bailey, in Queensland Agric. Journ. viii. 1901, p. 111); Grant described it as common everywhere (Trop. Africa, 5° S.) flowering in March (Botany of Speke and Grant Exp. Trans. Linn. Soc. xxix. p. 41); flowering, Cross River region, December and January (Holland, Herb. Kew).

Ref.—"Nzonogwi Fibre," in Bull. Imp. Inst. 1905, pp. 24–25.—"Denje and Nzonogwi Fibres," in "Jute Substitutes from the Nyasaland Protectorate," l.c. 1907, pp. 375–378.

HONCKENYA, Willd.

Honckenya ficifolia, *Willd.*; Fl. Trop. Afr. I. p. 260.

Ill.—Usteri, Delectus Opusc. Bot. ii. t. 4; Deless. Ic. v. t. 1 (*Clappertonia ficifolia*); Bot. Mag. t. 7836 (flowered at Kew September, 1901, seeds from Lagos).

Vernac. name.—Bolo-bolo (Lagos, *Moloney*, *Millson*). Agbourin Ilasa (Yoruba, *Moloney*, *Millson*, *Higginson*); Napunti (Sierra Leone, Bull. Imp. Inst. 1908, p. 132).

Lagos; Yoruba; Old Calabar; Cross River; Benin; Nupe; Bassa. Not recorded from any locality outside West Africa.

This is a valuable indigenous fibre plant. It was brought under notice perhaps for the first time by Mr. Alvan Millson, Commissioner of the Western District of Lagos, who sent in November, 1888, herbarium specimens, and a sample of the fibre to the Royal Botanic Gardens, Kew. The correspondence on the subject is given in the Kew Bulletin for 1889, p. 16. At that time Messrs. Ide & Christie considered there was a very wide field open to it commercially if it were capable of being produced in large quantities. Its market value would be regulated by that of jute, over which it would always command a higher price, and according to the prices then (December, 1888) ruling for jute, the bolo-bolo was valued at £16 per ton, with a possible advance to £20. In 1898 samples, prepared at the Botanic Station, Old Calabar, were valued by brokers in London at £26 per ton in bales; prices of all hemps, it was stated were then high, owing to shortage and speculation in Manila hemp. A report, from a manufacturer who described the fibre as jute, placed the value at £12 per ton (Report Bot. Garden, Old Calabar, 1898–99, and Bot. Enter. in W. Afr. 1889–1901, p. 171).

In 1907, on a sample from Sierra Leone, the valuation was £20 per ton; the fibre was described as jute-like, and said to be nearly as rich in cellulose as extra quality Indian jute. An analysis made at the Imperial Institute showed the following composition: moisture, 9·6 per cent.; ash 0·32 per cent.; loss on hydrolysis (*a*) 6·0 per cent.; loss on hydrolysis (*b*) 9·7 per cent.; acid purification, 0·4 per cent; cellulose, 78·3 per cent.; length of ultimate fibres, 2·0 mm. to 3·6 mm. The sample examined consisted of uncombed bast ribbons varying in length from 4 to 10 feet (Sierra Leone Gaz. February 9th, 1907, p. 64). The bast ribbons have been found suitable as a papermaking material, but the use for this purpose is considered prohibitive on account of the cost of production. It has been estimated that the ribbons cost about ½*d.* per lb. to produce, and give about half their weight of "half stuff," the most advisable form for shipping, valued at £7 to £8 per ton (Bull. Imp. Inst. 1908, p. 134). Strips of the bark are commonly used by the natives for rope or "tie-tie."

Under cultivation the plant may be propagated by seeds or by division of the roots, and requires a rich well-drained soil. The preparation of the fibre is the same as for jute (*q.v.*); the stems are best cut before the flowering is complete. In addition to its value as a fibre plant bolo-bolo is distinctly ornamental.

Ref.—"Fibre from Lagos," in Kew Bull. 1889, pp. 15–16. Reprinted in Add. Series II. pp. 30–31.—Sierra Leone Royal Gazette, February 9th. 1907, pp 64–65.—"Jute and Jute Substitutes from W. Africa," in Bull. Imp. Inst. 1908, *Honckenya ficifolia*, pp. 132–134.

CORCHORUS, Linn.

Corchorus capsularis, *Linn.*, Sp. Pl. p. 529.

Leaves 2–4 long, ¾–1 in. broad, glabrescent, oblong, acuminate, coarsely toothed, base generally prolonged into tail-like appendages; petiole 1½ in. Stipules ¼–⅓ in. Capsules oblate, subglobose, wrinkled, muricate, 5-valved, valves without transverse septa. Seeds few in each cell (Fl. Br. Ind. i. 1875, p. 397).

The globose capsule, without a beak, distinguishes it readily from *C. olitorius*, which has an elongated capsule with a beak.

Ill.—Rumpf, Amb. v. t. 78; Lam. Encycl. t. 478, f. 3 (fruit); Wight, Ic. Pl. Ind. or. i. t. 311; Jacq. Eclogae Pl. Rar. ii. t. 119; Hook. Kew Journ. Bot. ii. 1850, t. 3; Schnizlein, Ic. t. 212, f. 24; Vidal, Fl. For. Filip. t. 20 B; Zippel, Ausl. Handels, Nährpflan. t. 30; Journ. Proc. As. Soc. Beng. N.S. iii. December, 1907, p. 637, f. 7 (leaf in comparison with leaves of the varieties *Marua* figs. 1–3, *corylifolia*, f. 4, and *pyrifolia*, f. 5).

Jute.

Cultivated experimentally in Nigeria, and other parts of Africa. Largely cultivated in North-East India; country of origin uncertain. In 1896 the experimental cultivation of this plant was taken up; large quantities of seed were supplied by Messrs. Elder, Dempster & Co. to Lagos and Old Calabar, in common with other places on the West Coast of Africa. The fibre produced at Old Calabar in 1896 was good, but short, owing to late season and poor soil. The seed was received in August, sown on the 20th of this month, reaped in November, and samples (retted for about 12 days) despatched on the 1st December, 1896. Although sufficient to show that fibre of good quality could be produced in the country, the experiments were on too small a scale to prove the success of production on a commercial scale, and took no account of the labour and problems involved, other than the conditions of climate and soil. In the present instances the dry season was well advanced before growth was complete, and the soil was light and sandy, conditions that would cause the plants to flower and mature early.

In 1905 the subject was renewed by the Chamber of Commerce, Dundee, who brought before the Colonial Office the efforts that had been made by those interested in the jute industry of Dundee to encourage the growth of jute in West Africa, with, up to then, only moderate success. Messrs. Elder, Dempster & Co. offered to give free passage to and fro, and Dundee manufacturers through their Jute Association, or otherwise, were prepared to assist in procuring seed, and to contribute to the necessary expenses. It was represented that the chief difficulty lay in finding suitable experts (Dundee Chamber of Commerce to Colonial Office, 30th March, 1905), but the late Director of Kew was of opinion that this could be met by the Bengal Dept. of Agriculture. This course he accordingly recommended (Kew to Colonial Office, 12th April, 1905), and it was subsequently urged by the present Director (Kew to Colonial Office, 17th February, 1906). Jute seed was distributed, and a Memorandum on the Cultivation (by the Inspector-General of Agriculture, India) communicated to the West African Colonies, including Lagos, early in 1906 (Colonial Office to Kew, 14th February, 1906). Samples of fibre, subsequently submitted to the Imperial Institute from the Western Province of S. Nigeria, one (green stem) was reported on as being of very good quality—soft, well prepared, lustrous, of good length and strength, and regarded by commercial experts as equal to good medium Bengal jute, and worth £15 to £16 per ton (with "first marks" Calcutta jute at £14 per ton); another sample (red stem) was of similar quality, but somewhat darker in colour, valued at £13 to £14 per ton, and said to be saleable in any quantity (Bull. Imp. Inst. 1908, p. 126).

A sample from N. Nigeria, grown from imported seed, was described as soft, fine, greyish, fairly lustrous, but not well cleaned; about 4 feet long, worth £24 per ton (with medium jute at £23 to £25 per ton), and regarded as very suitable for the best purposes of jute spinning (l.c. p. 127).

Jute is manufactured into carpets, carpet backings, tarpaulins, backing for floor cloths, curtains, shirtings, paper (chiefly from the "butts" or fibre from the base of the stem), cordage, an admixture with and sometimes as a substitute for silk; an admixture with flax goods and hempen goods; and, perhaps the most important of all its uses, "gunny bags" or "gunnies." Wherever a trade in grain (wheat, rice, etc.) sugar, coffee, ground-nuts, potatoes and other products is carried on, it may in general be taken as the distribution of the gunny bag. Sir Alfred Moloney, under "Staple Articles of Trade," on a visit to the Eastern Limit of the Colony of Lagos (Benin River approximately), in 1881, notes that new or second-hand bags, after a rice voyage to Europe, are used for export of kernels, and that great loss in such bags is at times experienced from the ravages of the forest rats.

The so-called "jute butts" and the various qualities of cloth made from jute, ultimately find their way into the paper mills. On account of the introduction of other fibrous materials such as brown mechanical wood pulp, wood cellulose, etc., for the manufacture of wrapping papers, the demand for jute has diminished considerably, although it was formerly very extensively employed as a substitute for manila, which, on account of the extraordinary strength of the fibres, forms a very valuable paper-making raw material, especially for the manufacture of papers in which strength is of primary and colour of secondary importance (Hübner, in Journ. Soc. Arts, li. 1903, p. 836).

Amongst other uses to which the jute plant is put may be mentioned the dried leaves used medicinally in India, eaten at breakfast time with rice in cases of dysentery; the seed when fried yields an oil chiefly used for lighting purposes (Dict. Econ. Prod. Ind.). Three varieties of the plant, *Marua*, *corylifolia*, and *pyrifolia* are eaten as vegetables in India (Burkill & Finlow, in Journ. Proc. As. Soc. Bengal, December, 1907, p. 633).

The trade in jute in India from 1828 onwards appears to have always been continuous and steady. The beginning was small, the record being 364 cwt. for the imports to this country during the year mentioned, but it soon developed owing to the demand for the manufacture of gunny bags. Dundee was the chief centre for this manufacture, and with proper machinery, succeeded in diverting this industry from the home of the plant in India, causing more attention to be given to the production than to the manufacture. The gradual introduction, however, of modern machinery in India and the erection of mills in Calcutta, added to an increase in the application of the jute fibre to various purposes, has had the effect of increasing the demand for the raw material and the consequent improvement in the price. This is made evident by the fact that the Dundee operatives are seeking fresh sources of supply, and attention has in consequence been drawn to West Africa as a likely field, notwithstanding that the imports of fibre into the United Kingdom during 1906 from British India alone amounted to 362,262 tons, valued at £8,195,715. It may be mentioned that of this amount 305,413 tons came from Bengal, valued at £6,917,481, beside which the figures for other parts of India and foreign countries are insignificant, and may be regarded as having little or no influence on the trade. The total from all sources, including other British Possessions and foreign countries, was 369,789 tons, value £8,341,232 (Trade of the United Kingdom, 1907, p. 189). The foreign countries of the Customs Returns include Germany, Netherlands, France, Egypt, China and U.S. America. The European countries could only mean jute in course of transit ; the Chinese jute may have consisted entirely of the species under consideration or in part with *Abutilon Avicennae* and other species ; the Egyptian would be likely to be true jute, as also the American.

It has been stated that the jute-producing districts of Bengal will soon have covered the extent of their productive power and will be quite unable to keep pace with the demand, and the Government of India are already taking steps to increase the area under jute in districts outside Bengal. The outlook for the production in West Africa appears therefore to be a good one, more particularly on the lower reaches of the Niger or the lagoon country of Nigeria. It seems reasonable to suppose that the delta of the Niger would be as suitable for the cultivation as the delta of the Ganges, the present chief commercial source.

Jute at the present time realises good prices ; a recent return gives "good white to best" £23 to £28 per ton ; "good" £16 to £22 ; "medium" £13 to £15 10*s.* ; "common" £10 to £12 ; "rejections" £7 to £10 ; "cuttings" £3 to £6 per ton (Mon. Circ. Ide & Christie, 15th January, 1909).

Amongst the suggested and possible substitutes for jute have been mentioned several Malvaceous (*see* p. 66) and Tiliaceous (*see* p. 105) fibres.

The established competitors at the present time are *Abutilon Avicennae*, *Urena lobata*, and *Hibiscus cannabinus* ; the first mentioned is well known on the markets as a form of Chinese jute, the second as Aramina fibre, and the third as Bimlipatam jute.

The main requirements of jute under cultivation appear to be a tropical climate ; a rainfall of 50 inches and upwards ; a rich loam or deep alluvial soil, kept continually moist, though not stagnant, during the growing season, thoroughly tilled before sowing, and afterwards until the plants cover the ground.

It has been said that the best quality of jute is obtained from loamy soils, the heaviest yield from clay soils, coarse fibre from sandy soils, and that inundated lands induce root-growth from the stem with corresponding detriment to the fibre (Watt, Comm. Prod. Ind. p. 413).

In soils requiring manure, about 15 tons of well-decayed farm manure per acre has been recommended to be ploughed in before sowing (Mollison, Memo. to Col. Office, February, 1906) ; where silt is deposited annually very little manure is given, otherwise cultivators apply farmyard manure at the rate of 150 maunds per acre (maund = 82·3 lbs.) = 5½ tons approx., and in experiments with bone meal, castor cake, saltpetre, superphosphates and cowdung, it was found that cowdung gave the best results (Watt, *l.c.* p. 415). It has also been stated that an application of 100 maunds (4 tons approx.) of cowdung per acre will be found very efficacious (Smith, Agric. Journ. Ind. ii. 1907, pt. 2, p. 160).

The seed may be sown broadcast, the amount required per acre being given as about 8 lbs. (Watt, *l.c.* p. 414), or at the rate of 10 to 15 lbs. per acre (Mollison, *l.c.*).

Germination takes place in a few days, and in about a fortnight the plants will be developing their second leaves. The plants are thinned out to a distance of from 4 to 6 inches, or kept sufficiently close to prevent branching. The crop may take from three to four months to come to maturity, and harvesting should be commenced when the plants are partly in flower and partly in fruit.

The stems are cut near the ground, tied into bundles, stooked for a few days, until the leaves dry, and then submerged in a tank or pool of clear water to ret or steep until the fibre is found to separate without difficulty from the stem. The retting may occupy from 10 to 25 days, according to the weather and to the condition of the plant, and it is important that the stems be removed at the right time as the fibre soon becomes impoverished and discoloured if allowed to remain in the water too long.

The fibre is stripped from the stems, washed for preference in running water, until all the bark is removed, and then dried in the sun.

When thoroughly dry the fibre is graded and baled for export. The rough ends ("jute butts"), six to eight inches approximately, are cut off and baled separately. The standard of baling is of importance, and shippers in Calcutta have the right to reject bales if it is found that out of five examined there are more than 2½ per cent. of cuttings (U.S. Cons. Rep. May, 1908, p. 142). The baling is usually done by machinery, and a commercial bale weighs 400 lbs.

A good crop is estimated at from 2,400 lb. to 2,600 lb. of fibre per acre (Mollison, Memo. to Col. Office, February, 1906). Another estimate is given as from 6–9 maunds (493–740 lb. approx.) to 36 maunds (2,962 lb.), or an average of 14 maunds (1,152 lb.) per acre (Watt, Comm. Prod. Ind. p. 415).

The stems grow to a height of 10–12 feet (Mus. Kew).

The dock charges on bales are: landing at the dock where the ship discharges, opening for Customs inspection, and delivery, 3*s*. 9*d*. per ton; weighing 10 per cent., for average 5*s*. per ton; rent per week from breaking bulk of vessel, including insurance against fire, 3*d*. per ton. Working charges when ordered: weighing 90 per cent.; examining for damage, classifying damages, sampling, tightening, relashing, including materials—if ordered before landing, 1*s*. per ton; if ordered subsequently to landing, 2*s*. 3*d*. per ton; weighing at the time of delivery, 1*s*. 6*d*. per ton; examining for damage at the time of delivery, 1*d*. per bale; repiling when done, 1*s*. 6*d*. per ton. When a percentage only of a parcel is ordered to be landed and weighed the following rate is applied: selecting, landing, weighing and delivery to craft, within 3 clear days of final weighing, and fire insurance, 5*s*. per ton (Table of Rates, &c. London & India Docks Co. 1904, p. 36).

The quality and the causes of deterioration in jute have been at various times the subject of much discussion.

It is stated that very little jute arrives in England in as good a condition as when shipped. Being a chemically sensitive substance it is considered that it requires to be dealt with much more carefully than does cotton, to prevent undesirable changes being established. The incipient fermentation which is set up by the treatment of retting is very liable to be renewed during packing and shipment (*see* Technical Reports and Scientific Papers, Imperial Institute, p. 61, where several analyses are given showing the want of uniformity in jute fibre as imported into England).

A series of experiments conducted at the Imperial Institute with stems cut before flowering, after budding, in flower, in pod, and when fully matured, shewed no very important variation in the chemical analysis, and demonstrated that there is no marked change in the nature of the bast fibre at critical stages in the growth. From experiments towards improvement in the methods of preparation it was concluded that attempts at special treatment of the fibre in India, before supply to the jute mills, or before shipment are not to be advocated (Tech. Rep. and Sci. Papers, Imp. Inst. pp. 63, 67).

Watering the prepared jute is a common source of injury in India attributed to the dealers. It is possible that the quality varies according to the form grown under certain geographical conditions. Burkill & Finlow have distinguished 33 races of *Corchorus capsularis*, the primary distinctions based on the colour of the stem, red or green (Agric. Ledg. No. 6, 1907, p. 133). Smith recommends growing "Baran of Mymensingh"; "Amonia of Faridpur"; "Kakyabombai of Serajganj"; "Deswal of Serajganj"; "Barapat of Mymensingh"; all green-stemmed forms (Agric. Journ. Ind. April, 1907, p. 150). Watt states that the finest grade is said to be the "Uttariya," which is strong, long, and easily spun, brilliant in colour and of fine texture; "Deswal" the next most valuable grade; "Desi" or "Daisee," most generally used in the gunny trade, and "Deora" or "Dourah," used in rope manufacture. He also specially mentions "Narainganji," an excellent fibre, long and soft; "Serajganje," from Pabna, and "Maimensingh" (Comm. Prod.

Ind. p. 418). Prain states that a strain natural to or acclimatised in a particular district gives better results in that district than any freshly imported seed (l.c.).

Rotation crops are advisable, but catch crops cannot be grown with jute. In India it is stated to grow very well in rotation with rice and potatoes. On low-lying land a good crop of Aman Paddy can be obtained, while on high irrigable land potatoes may be grown after jute in the same year (Smith, in Agric. Journ. Ind. April, 1907, p. 150). It would require some experiments before deciding on the best rotation crops suitable for Nigeria, although in view of the requirements of jute the choice would probably be a limited one.

Ref.—Spon's Encycl. Industr. Arts, Div. iii. 1881, Cultivation, Preparation, &c., pp. 940–945 ; l.c. Div. iv. "Jute Manufactures," pp. 1170–1186, illustrated.—Dict. Econ. Prod. Ind. ii. 1889, pp. 535–539 ; l.c. iv. 1890, pp. 558–560, reproduced in Handbook No. 5, 1892, Imp. Inst. Series, pp. 1–22.—"Comm. Fibres," Morris, in Journ. Soc. Arts, xliii. 1895, pp. 906–907.—"Systematic Account of the Jute Fibre as the typical lignocellulose," in Cellulose, an Outline of the Chemistry of the Structural Elements of Plants, Cross and Bevan, p. 109 (Longmans, Green & Co., London, 1895).—"Methods of Harvesting Jute and Preparing it for the Market," in Agric. Ledger No. 37, 1896, pp. 1–38.—Descr. Cat. Useful Fib. Pl. of the World, Dodge, Rep. No. 9, 1897, pp. 125–133, U.S. Dept. Agric. Fib. Investigations.—"Preparation of Jute," in Tech. Rep. and Sci. Papers, Imp. Inst. 1903, pp. 60–68.—"Two varieties of Indian Jute offered for sale on the London Market," l.c. pp. 86–88.—"Jute ou Gunny," in Pl. Util. Congo, De Wildeman, Art. xvi. pp. 199–221.—"The Cultivation of Jute and Similar Fibres," in Bull. Imp. Inst. 1905, pp. 251–262, with note on "The Prospects of Jute Growing in West Africa," and "Jute Substitutes."—"The extension of Jute Cultivation in India," Finlow, in Bull. Agric. Research Inst. Pusa, July, 1906, pp. 1–46.—"On three varieties of *Corchorus capsularis*, Linn., which are eaten," Burkill and Finlow, in Journ. and Proc. Asiatic Soc. Bengal, 1907, pp. 633–638.—"Insect Pests of Jute," Lefroy, in Agric. Journ. Ind. April, 1907, pp. 109–115, with illustrations of the Jute Semi Looper (Plate X.) and the Jute Weevil (Fig. 1, p. 115).—"Jute Experiments in Bengal," Smith, l.c. pp. 140–160.—"The Races of Jute," Burkill and Finlow, in Agric. Ledger, No. 6, 1907, pp. 41–137.—"Jute and Similar Fibres," in Bull. Imp. Inst. 1907, pp. 2–4.—"Extension of the Cultivation of Jute and Similar Fibres in India," l.c. pp. 266–269.—"Jute Substitutes from the Nyasaland Protectorate," l.c. pp. 374–378.—"Jute and Jute Substitutes from West Africa," l.c. 1908, pp. 126–135.—Comm. Prod. Ind. Watt, 1908, pp. 405 427 ; dealing with the cultivation, areas of production, separation of the fibre, grading, baling, qualities, manufactures, trade, &c.

Corchorus olitorius, *Linn.* ; Fl. Trop. Afr. I. p. 262.

Ill.—Trew, Pl. rar. t. 4 ; Lam. Encycl. t. 478 ; Bot. Mag. t. 2810 ; Schnizlein, Ic. t. 212, f. 25 (fruit) ; Vidal, Fl. For. Filip. t. 20 A ; Zippel, Ausl. Handels. Nährpflan. t. 30 ; Revue Cult. Col. i. 1897, p. 79 ; Journ. Proc. As. Soc. Beng. December 1907, p. 637 (leaf in comparison with *capsularis* and vars.).

Vernac. names.—Eyo or Ayo (Yoruba, *Cole*); Ewedu (Lagos, *Dawodu*); Etinyön (Eifik, *Holland*); Eyo-Ganbi (Oloke-Meji, *Dodd*); Crin-Crin (Sierra Leone, *Dudgeon*); Ingle (Sierra Leone, *Scott Elliot*); Melokych (Arabic, *Forskal*).—Gemüse Corchorus; Jews Mallow; Bristly leaved Corchorus; Jute.

Old Calabar; Cross River; Lagos; Yoruba; Oloke-Meji. Widely distributed throughout the Tropics, and many warm countries.

A source of jute, though according to Watt (Com. Prod. Ind. p. 409) it is said to yield a fibre inferior to that of the preceding species and is never cultivated where it is possible to grow *C. capsularis.* In India it is invariably found on high and dry land, preferring sandy loams, and taking longer to come to maturity.

A specimen of the fibre of this species from the Onitsha Plantation was valued at £14 10*s.* per ton (with medium jute at £14–£16 per ton). It was described as harsh, of pale buff colour and fair lustre, of poor strength; and it was suggested that the sample had been retted for too long a period (Bull. Imp. Inst. 1908, p. 126).

A specimen of native jute described in the Bulletin of the Imperial Institute (1908, p. 127) probably belongs here. It was cultivated by riverside villagers in Borgu Province, N. Nigeria, and was described as nearly white, fairly well cleaned, rather harsh and weak; about five feet long. The analysis showed the following composition: moisture, 9 per cent.; ash, 0·3 per cent.; (*a*) hydrolysis (loss), 9·8 per cent.; (*b*) hydrolysis (loss), 15·1 per cent.; acid purification (loss), 0·1 per cent.; and cellulose 76·5 per cent. On the whole it was considered of good quality, slightly inferior to a specimen of "extra fine quality" Indian jute, as it contained less cellulose and suffered a greater loss on hydrolysis.

For further particulars in connection with this plant for the production of fibre, see the preceding species. Burkill and Finlow distinguish between five races of *C. olitorius* (Agric. Ledger, No. 6, 1907, p. 134).

This species appears to be of importance as a vegetable, and is cultivated in many countries for this purpose. In Old Calabar and other parts of S. Nigeria the leaves are used in soups. It is cultivated for the same purpose in Uganda (Dawe, Herb. Kew), in Sierra Leone as a pot herb (Scott Elliot, Herb. Kew); in Liberia eaten as a vegetable (Stapf, in Liberian Flora ii. p. 583), and in France the plant is cultivated in gardens, the young and tender leaves being used in salads (Vilmorin-Andrieux, Les Pl. Potagères, 1904, p. 198). In India, in addition to its use as a vegetable, it is used medicinally as a bitter tonic, &c.; the stalks after the removal of the fibre, are used for making gunpowder charcoal, and in the manufacture of baskets (Dict. Econ. Prod. Ind.).

Ref.—Dict. Econ. Prod. Ind. ii. 1889, pp. 540–541.—"Jute from the Gambia," in Kew Bulletin, 1898, pp. 38-40, reprinted in Add. Series II. pp. 32–33.—Comm. Prod. Ind. Watt, 1908, p. 407.—See also many of the references to *C. capsularis.*

Corchorus tridens, *Linn.*; Fl. Trop. Afr. I. p. 264.

Ill.—Burman, Fl. Ind. t. 37, f. 2 (*C. trilocularis*).

Vernac. names.—Quisanani or Quijanána (Angola, *Welwitsch*).

Nupe; Onitsha. Widely distributed in Tropical Africa, &c.

The young tops, according to Welwitsch, are cooked with palm-oil, and used as spinach by the natives of Angola (Hiern. Cat. Welw. Afr. Pl. i. p. 101).

The plant yields a fibre, but little seems to be known about it; De Wildeman mentions it with other species under "Jute ou Gunny" (Pl Util. Congo, Art. xvi. p. 203). Grows in yam fields at Onitsha, and about cultivated places in Nupe (Barter, Herb. Kew).

GLYPHAEA, Hook. f.

Glyphaea grewioides, *Hook. f.*; Fl. Trop. Afr. I. p. 267.

Ill.—Hook. Ic. Pl. t. 760; Hook. Niger Fl. t. 22.

Vernac. names.—Atorin, or Atori (Yoruba, *Millson*, *Foster*); Uweheyota, or Unweriotan (Benin, *Thompson*, *Dennett*).

Yoruba; Benin; Guarara River; Dekina, Bassa Province.

The Yorubas use the plant as a remedy, taken internally, fòr gonorrhœa, and also as a tonic (Kew Bull. 1891, p. 217).

LINEAE.

ERYTHROXYLON, Linn.

Erythroxylon Coca, *Lam.*, Encycl. ii. (1786) p. 393.

A shrub or small tree 2–5 feet high, erect and moderately branched; bark usually reddish brown, passing in older specimens into greyish brown; branches scarred where the leaves have fallen off; young twigs smooth. Leaves chiefly on upper branches, alternate, soon falling, one to three inches long, lanceolate or oval, sometimes attenuated into the petiole, but in the type more or less acute at both ends, apex mucronate, perfectly entire, dark green above, paler and glaucous beneath, quite glabrous, mid-rib prominent beneath, lateral veins numerous, faint, freely anastomosing, the areolated portion slightly concave, paler and extending from base to apex on each side of the mid-rib; petiole from $\frac{1}{4}$–$\frac{1}{3}$ inch long; stipules small, closely pressed to the stem, and united along their inner edge to form a single triangular, acute, toothed organ, intrapetiolar (placed between the petiole and the stem) very persistent, at first thin, greenish and transparent, becoming on old branches, brown, stiff and spinous. Flowers, small, white, inodorous, on slender drooping glabrous pedicels, about $\frac{1}{4}$ inch long, several together in the axils of the leaves, calyx very deeply cut into five triangular-ovate, acute, glabrous segments. Petals five, alternating with the calyx lobes. Stamens 10. Ovary superior. Fruit, a small indehiscent, red, smooth drupe, one-celled, one-seeded by suppression, about $\frac{1}{2}$ inch long, oblong-ovoid, pointed, when dry, furrowed. Seed filling the endocarp, testa thin, embryo straight, with a superior radicle and flat cotyledons (Kew Bulletin, 1889, p. 3.), *Ill.*—Cav. Diss. t. 229 ; Ruiz, Lopez and Pavon, Fl. Peruv. Tabulae ined. t. 398; Hook. Comp. Bot. Mag. ii. 1836, t. 21 ; Martius, Beitr. Kennt. Gatt. *Erythroxylon* (Abh. Bayer. Akad. iii.) t. 6 ; Le Maout and Decaisne, Botany (Hooker's Transl.) p. 295 ; Baillon, Hist. Pl. v. p. 50, ff. 80–87 ; Kew Bull. 1889, p. 4, f. 1 ; Teysmannia, Batavia, i. 1890, p. 449, t. 1, f. 1 ; t. 3 (*E. bolivianum*) ; Journ. Linn. Soc. xxv. 1890, p. 382, f. 1 ; Nicholls, Trop. Agric. p. 235 ; Pharm. Journ. [3] xxii. p. 818, f. 4 (var. *bolivianum*), l.c. [4] viii. p. 484 ; l.c. xii. p. 3, ff. 1, 2, p. 4, f. 3. Bot. Mag. t. 7334 ; Engl. and Prantl, iii. p. 4, f. 34A ; Cat. Pl. Hort. Col. Brux. p. 78 ; Druggists Circ. and Chem. Gaz. November, 1900, p. 220, ff. 1 and 3 (excluding fruit in fig. 1) ; Nat. Stand. Disp. 1905, p. 445 (leaf of Huanuco Coca) ; Engler, Das Pflan. iv. 134, 1907, p. 84, f. 17 ; Teysmannia, Batavia, xix. 1908, pp. 420, 421.

Coca ; Huanuco Coca.

Erythroxylon novogranatense (*Morris*) *Hieronymus*, in Engler's Bot. Jahrb. xx. Beibl. n. 49 (1895), p. 35.

[*E. Coca*, Lam., var. *novo-granatense*, Morris, in Kew Bull. 1889, p. 5 ; *E. Coca*, Lam., var. *Spruceana*, Burck., in Teysmannia, 1890, p. 456 ; *E. truxillense*, Rusby, in Druggists' Circ. and Chem. Gazette, 1900, p. 220.]

A leafy bushy plant, bark greyish brown, branches numerous and somewhat spreading (not erect as in *E. Coca*). Leaves usually smaller than *E. Coca*, 2 inches long, 1 inch broad, crowded, membraneous, bright green above, paler and glaucous beneath, obovate lanceolate, narrowly attenuated into the petiole, apex rounded, often emarginate, with a small apiculus in the notch (Kew Bull. 1889, p. 5).

Ill.—Regel, Gartenflora, xviii. 1869, t. 615 (*E. mexicanum*) ; The Garden, ix. 1876, p. 445 ; Bentl. and Trimen, Med. Pl. t. 40 (*E. Coca*) ; Kew Bull. 1889, p. 5, f. 2 (var. *novo-granatense*) ; Journ. Linn. Soc. xxv. 1890, p. 384, f. 2 (var. *novo granatense*) ; Teysmannia, Batavia, i. 1890, p. 449, t. 1, f. 2 (var. *novo-granatense*), t. 2 (var. *Spruceanum*) ; Pharm. Journ. [3] xxii. p. 818, f. 2 (var. *novo-granatense*), f. 3 (var. *Spruceanum*) ; l.c. [4] viii., p. 484 ; l.c. xii. p. 81 (*E. truxillense*), p. 82 (*E. truxillense*) ; Druggist's Circ. and Chem. Gaz. November, 1900, p. 222, f. 15 ; l.c. March, 1901, p. 49, ff. 1 and 2 (*E. truxillense*) ; Nat. Stand. Disp. 1905, p. 445 (leaves of Java and Truxillo Coca) ; Engler, Das Pflan. iv. 134, 1907, p. 86 ; Teysmannia, Batavia, xix, 1908, p. 421 (*E. novo-granatense*), p. 422 ("Java Coca," *E. novo-granatense*).

Coca, or Cuca (Peru, *Peyritsch*) ; Truxillo Coca.

The Coca leaves of commerce are obtained from the plants above mentioned. Peruvian Coca is usually known as "Truxillo," and Bolivian as "Huanuco." Other important sources of the drug are Ceylon and Java.

The leaves are used in Peru, Bolivia, Brazil and other parts of South America as a stimulant, in much the same way as the Cola nut is used in West Africa. They are officially recognised in the British Pharmacopoeia as "Cocae foliae," as well as the alkaloid extract Cocaine. Coca wine and several other preparations are made from the leaves. The Huanuco leaves are used for making Cocaine, the important anaesthetic, and the Truxillo leaves for Coca wine and in Pharmacy; the latter are as strong as the former in alkaloid, but the product will not crystallise (Burgoyne and Burbidge in Kew Bull. 1889, p. 13). The Indian's standard of distinction for leaves for chewing is sweet leaves, " Najas dulces," and bitter leaves, " Najas amargas " (l.c. p. 7).

Coca is cultivated in the Botanic Gardens of Southern Nigeria and the plants grow freely. An equable and moist climate, with a temperature not lower than 60°, rich loamy soil, well drained, full sunlight, and judicious pruning, are the chief requirements under cultivation. *E. Coca*, grown mostly in Bolivia and Peru, is said to thrive best and to produce the best product at an altitude of 3,500 to 6,000 feet (Nat. Stand. Disp. 1905, p. 444). It is found in Peru up to an altitude of 7,000 feet, and is principally produced in the Provinces of Otuzco, Huamachuco Huanuco, Tarma, Huanta, Cuzco, and Urubamba; the last mentioned place produces the finest leaves, said to produce the best cocaine (Cons. Rep. Ann. No. 4074, 1908, p. 30). *E. novo-granatense* is believed to be more suitable for lower elevations approaching sea level. Plants may be raised from seed, and planted out when several inches high into permanent places 4 to 5 feet apart. The plants would probably grow much larger than this space allows, but since it is the leaf crop that is wanted, the cutting back necessary to keep them within bounds will be beneficial.

In Peru the plants yield a crop after three years, and a full grown shrub may yield two or three good crops in the course of a year (Kew Bull. 1889, p. 7). It has been estimated that 100 plants will yield 26 lbs. of leaves at a crop, and 800 lbs. of leaves is given as the yearly production of an acre (Spon's Encycl. p. 1307). An average return in Java is given at 720 lbs. of leaves per acre, and the plantations are replanted after about 18 years (Agric. News, Barbados, 1907, p. 127, from Tropenpfl. February, 1906). Rusby (Nat. Stand. Disp. 1905, p. 445) gives 60–80 lbs. of dried leaves per acre as a fair yield at a picking.

The fully developed green leaves only are gathered for market. They are in good condition if they snap when doubled, and before they are ready to fall.

Drying is the only preparation required, and the leaves are usually sun-dried, shade-dried, or artificially dried. Leaves dried gradually in the shade are considered the best, and if artificial drying is resorted to the temperature, according to Dr. Warden, should not be much higher than 150° F. (Kew Bull. 1889, p. 7).

In S. America the leaves are dried quickly, within two or three hours, in hot sunshine, and not the least moisture is allowed to reach them. After lying in a loose pile in the coca house for two or three days they are again briefly exposed to the sun to dispose of any moisture which has accumulated; they are then powerfully compressed into small bales called " cestos," nominally of 25 lbs. each. Two " cestos " are then sown into a raw hide and, when this is thoroughly dried, they are ready for transportation

(Nat. Stand. Disp. 1905, p. 445). In Java it is usual to pack the powdered leaves in tins which hold about 165 lbs. (Agric. News, Barbados, 1907, p. 127).

Coca leaves rapidly lose in cocaine percentage if exposed to damp air (Pharm. Journ. [4] ix. p. 496), and they deteriorate in proportion to length of time kept.

The percentage of cocaine is very variable under cultivation, and cannot be depended upon to come up to a paying standard. It may vary according to altitude, soil, season, preparation, conditions under storage, &c. A good marketable percentage has been given as ·6 to ·8 per cent., this being characteristic of the leaves that come into London (Mus. Kew). A sample of leaves from Sierra Leone, collected from a plant 5 years old, was valued in London (1901) at 6*d.* to 9*d.* per lb. for shade-dried leaves, and 5*d.* to 6*d.* per lb. for sun-dried leaves (l.c.). Leaves grown at the Victoria Botanic Gardens (Cameroons) were found to contain only ·28 per cent. of total alkaloid. The low yield was attributed either to improper drying or to deterioration during the long voyage (Pharm. Journ. [4] xv. p. 463).

Coca leaves may realize from 1¾*d.* to 9½*d.* per lb. In April, 1908, on the London market, fair green Ceylon (Huanuco character) sold at 6½*d.*; thin green Ceylon (Truxillo character), rather broken, at 6½*d.*; duller green at 4½*d.*, and common brown at 1¾*d.* per lb. in original bulk quantities (Chem. and Druggist, April 11th, 1908, p. 576). In February, 1909, 64 cases Ceylon-Huanuco sold at 8*d.* for middling brownish to 9½*d.* for fair greenish (l.c. February 13th, 1909, p. 273). Recently, fair to good green Ceylon-Huanuco sold at from 8*d.* to 8½*d.* per lb. (l.c. March 13th, 1909, p. 435). It is held that the Ceylon leaf brings higher prices than the South American, and is largely the standard of the market (Col. Rep. Ann. No. 527, 1907, p. 30).

It would appear to be advisable and practicable, under certain conditions, to prepare the crude extract for shipment.

Cocaine manufactories have been established in Peru for several years; it is now manufactured in Lima, Callao, Otuzco, Cajamarca, Huanta, and Cuzco. The production from 25 lbs. of coca leaves is 1,466 grains of cocaine, and the exportation during 1904 was 7,527·931 kilos, value £94,099; 1905, 6,778·498 kilos, value £116,590, and in 1906 5,914·307, value £79,071, 80 per cent. being exported from Callao (Cons. Rep. Ann. No. 4074, 1908, p. 30). Crude cocaine has realized on the Hamburg market 260 m. (£13) per kilog. (Chem. and Druggist, August 8th, 1908, p. 246), and cocaine hydrochloride is valued in Hamburg at 280 m. (£14) per kilog. (Chem. and Druggist, March 13th, 1909, p. 436); 8*s.* 6*d.* to 8*s.* 10*d.* per oz. (l.c. March 27th, 1909, p. 507).

Ref.—"Some Account of the Uses and Properties of Coca," Sir W. J. Hooker, in Comp. Bot. Mag. i. 1835, pp. 161–170.—"Note Sur la Cuture de L'*Erythroxylon Coca*," Martinet, in Bulletin de la Soc. d'Acclimatation, July, 1874, pp. 449–455.—"A few further Notes on Coca Leaf," Simmonds, in the Chemist and Druggist, May 15th, 1876, pp. 155–156.—"*Erythroxylon*

Coca" in Medicinal Plants, Bentley & Trimen, i. No. 40 (J. & H. Churchill, London, 1880).—"Coca," "Cuca," or "Khoka," in Spon's Encycl. Div. iv., 1881, p. 1307.—La Coca du Pérou, et ses Applications Thérapeutiques, Dr. Lelong, pp. 1–15 (A. Clavel, Paris, 1883).—Coca, Its Source, Culture, Uses, &c., Dr. Bidie, pp. 1–13 (Higginbotham & Co., Madras, 1885).—"The Cultivation of Coca," Dr. Rusby, in Pharm. Journ. [3] xvi. 1886, pp. 705–707.—The Coca of Peru and Its Immediate Principles, their Strengthening and Healing Powers, Dr. Thudicum (Ballière, Tindal & Cox, London, 1886), Review in Pharm. Journ. [3] xvi. 1886, p. 719.—"Cocaine and Its Salts," Dr. Paul, in Pharm. Journ. [3] xviii. 1888, pp. 781–785.—"Note on *Erythroxylon Coca* grown in India," Dr. Warden, in Pharm. Journ. [3] xviii. 1888, pp. 1010–1012, and pp. 1027–1032 (reprinted from the Journ. of the Agric.-Hortic. Soc. India.—"Note on Hygrine," Dr. Stockman, l.c. p. 701.—"Coca at Home and Abroad," Dr. Rusby, in The Therapeutic Gaz. New York, March 1888, 14 pages.—"Coca" (*Erythroxylon Coca*, Lamarck; and *E. Coca*, var. *novo-granatense*), in Kew Bull. 1889, pp. 1–13, dealing with the History, Culture and Preparation of Coca Leaves, Analysis of Leaves, other species of Erythroxylon, and Value of Coca Leaves.—"Earliest Notice of Coca," l.c. pp. 221–222.—"*Erythroxylon Coca*," in Medizinal Pflanzen, Köhler, i. 2 pages.—"*Erythroxylon Coca*," in Dict. Econ. Prod. India, Watt, iii. 1890, pp. 270–276, Cultivation, Collection, Manufacture, Medicine, Chemistry, Trade, &c.—"Coca Cultivation," Sir Clements Markham, in Imp. Inst. Journ. i. No. 1, p. 16.—"Opmerkingen overde onder den naam, van *Erythroxylon Coca* in Nederlandsch Indie Gecultiveerde Gewassen," Dr. Burck, in Teysmannia, Batavia, i. 1890, pp. 385–398; 449–464; Abstract in Pharm. Journ. [3] xxii. 1892, pp. 817–819.—Coca and Cocaine, their History, Medical, and Economic Uses, and Medicinal Preparations, Martindale, pp. 1–76 (H. K. Lewis, 136, Gower Street, London, 1892).—"Coca," in Tropical Agric. Nicholls, Dominica, pp. 234–237 (Macmillan & Co., London, 1892.)—"Cultivation of Coca in India," in Kew Bull. 1894, p. 151.—"Ceylon Coca Leaves," with Analysis, l.c. p. 152.—"Coca du Perou," in Les Pl. Industrielles, Heuze, iv. pp. 251–255 (Libr. Agric. de la Maison Rustique, Paris, 1895).—"The Determination of Total Alkaloids in Coca Leaves," Gunn, in Pharm. Journ. [4] iii. 1896, pp. 249–250.—"Coca," in Les Drogues Simples d'origine Vegetale, Planchon and Collin, ii. pp. 688–694 (Octave Doin, Paris, 1896).—"Coca" *Erythroxylon Coca*, Lam.), Bailey, in Queensland Agric. Journ. i. October, 1897, pp. 330–331.—"Cocae Folia," Macroscopic and Microscopic Characters, in Pharm. Journ. [4] viii. 1899, pp. 484—485, with 8 figures.—"Coca Leaves," in Pharm. Journ. [4] ix. 1899, p. 496.—"The Botanical Origin of Coca Leaves," Dr. Rusby, in the Drugg. Circ. and Chem. Gaz. November, 1900, pp. 220–223, with 16 figures, including cultivated and uncultivated species of Erythroxylon, and commercial forms of the leaves.—"Cocae Folia," in Pharm. Journ. [4] x. 1900, p. 410.—"More Concerning Truxillo Coca Leaves," Dr. Rusby, l.c. March, 1901, pp. 48–49.—"The Botanical Source of Commercial Coca Leaves," Holmes, in Pharm. Journ. [4] xii. 1901, pp. 3–4; *Ibid*, pp. 81–82.—"Coca Leaves" (Vegetable Powders and their Diagnostic Characters), in Pharm. Journ. [4] xiii. 1901, p. 297.—"The Structure of Coca Leaves," Greenish, in

Pharm. Journ. [4] xviii. 1904, pp. 493–496, with 9 figures.—"Coca," "Cocaine," "Cocaine Hydrochloride," in the National Standard Dispensatory, Hare, Caspari and Rusby, pp. 444–452 (Lea Bros. & Co., Philadelphia and New York, 1905).—"Über die Kultur des Kokastrauches, besonders in Java," Dr. Winkler, in Tropenflanzer, February, 1906, pp. 69–81, Abstract in Agric. News, Barbados, 1907, p. 127.—"Komt in de Java-Coca Kristalliseerbare," K. de Jong, in Teysmannia, Batavia, xix. 1908, pp. 416, 418.—"De Cocaplanten," K. de Jong, l.c. pp. 419–421.—*Erythroxylon Coca*, in Comm. Prod. India, Watt (John Murray, London, 1908), pp. 523–525.

HUMIRIACEAE.

AUBRYA, Baill.

Aubrya gabonensis, *Baill.*; Fl. Trop. Afr. I. p. 275.

Vernac. names.—Ozonga, Issoua (Congo, *De Wildeman*).—Mahogany Bark Tree (Oldfield, Mus. Kew).

Brass.

The timber is good. White and easy to work (De Wildeman, Pl. Util. Congo, Art. xxvi. p. 337).

A fermented drink (*Stoutou*) is made from the fruits by the natives of the Gaboon (Moloney, For. W. Afr. p. 291).

GERANIACEAE.

BIOPHYTUM, DC.

Biophytum sensitivum, *DC.*; Fl. Trop. Afr. I. p. 297.

Ill.—Rheede, Hort. Mal. ix. t. 19; Jacq. Monogr. *Oxalis*, t. 78, f. 4 (*Oxalis sensitiva*); Wight, Illust. t. 62 (*B. Candolleanum*); Bot. Reg. t. 68 (*Oxalis sensitiva*); Savi, Sul, *Biophytum sensitivum*, tt. 1, 2; Peters, Mozamb. t. 15 (*B. Petersianum*); Engl. and Prantl, Pflan. iii. pt. 4, f. 14 G (fruit); Thonner, Blütenpfl. Afr. t. 70.

Vernac. name.—Patonmo (Ebute Metta, *Millen*).—Sensitive Wood Sorrel.

Lagos: Niger. Cosmopolitan in the Tropics.

In India the powdered seeds are applied to wounds, and with butter to abscesses to promote suppuration; a decoction of the root is given in gonorrhœa and lithiasis (Pharmacog. Indica, i. p. 248). Used medicinally in Lagos, and said to be a charm for snakes (Millen, Herb. Kew).

Ref.—Sul *Biophytum sensitivum* DC., Pietro Savi, Prof. Bot. Univ. Pavia, pp. 1–10 (Torino, Stamperia Reale, 1861).

RUTACEAE.

ZANTHOXYLUM, Linn.

Zanthoxylum senegalense, *DC.*; Fl. Trop. Afr. I. p. 305.

Vernac. names.—Ughahan (Benin, *Unwin*); Ata (Lagos, *Foster, Dawodu*); Artar (Pharm. Journ. [3] xx. p. 163).—Sabicu.

Niger: Benin.

Samples of the wood from Benin, believed to be of this species, have been valued on the Liverpool market at 2*d.* to 2½*d.* per foot, classified as mahogany (Kew Bull. 1908, p. 194). The wood is suitable for cabinet work (Les Bois Industr. i. p. 236).

The bark is aromatic, sudorific, and stimulant; reduced to a powder and soaked in water it is applied by the natives for the cure of rheumatic affections (Moloney, For. W. Afr. p. 293).

The "Ata" or "Artar" Root (Bark) of W. Africa is attributed to this species. It has been examined by Giacosa and Soare who have found it to contain a fixed oil, a crystalline substance, melting at 120°, and three alkaloids, the principal being named "Artarine" (Pharm. Journ. [3] xx. p. 163, and Year Book, Pharm. 1890, p. 150).

The tree is found in the mixed forests of S. Nigeria (Thompson, Col. Rep. Misc. No. 51, 1908, p. 61).

CITRUS, Linn.

Citrus Aurantium, *Linn.*, Sp. Pl. (1753) p. 783.

A small tree, up to 20 feet in height, usually with a straight trunk and well developed, spherical head. Leaves ovate-oblong, acuminate; petioles winged. Flowers white. Fruit yellow or golden when ripe, globose, or oblate-sphaeroidal, from about 2½ to 4 inches in diameter; rind thin; smooth or nearly so; pulp sweet.

Ill.—Rumpf, Amb. ii. t. 35; Plenck, Ic. t. 580; Duhamel, Traite des Arbres, vii. tt. 33, 37; Woodv. Med. Bot. iii. t. 188; Dict. Sc. Nat. t. 159; Desc. Ant. i. t. 38; Tuss. Ant. iii. t. 14; Hayne, Darst. Beschr. Gewäche, xi. t. 28; Guimpel, Abbild. Beschr. t. 71; Drapiez, Herb. Amat. de Fleurs, iv. t. 242 (var. *melitense*); Burnett, Pl. Util. i. t. 3a; Risso and Poiteau, Orangers, tt. 3–29; Bentl. and Trimen, Med. Pl. t. 51; Nicholson, Dict. Gard. f. 460; Bonavia, Cult. Orang. and Lem. India, tt. 40–58; Sauvaigo, Les Cult. Medit. figs. 106 and 107; Freeman & Chandler, World's Comm. Prod. pp. 271, 273.

Vernac. name.—Orombo (Lagos, *Dawodu*).—Sweet Orange.

Var. **Bigaradia,** *Duhamel*, Traite des Arbres, vii. p. 99.

Differs chiefly from the type in the longer spines, fruit rough skinned; of deeper colour, bitter pulp, and aromatic rind.

Ill.—Duhamel, Traite des Arbres, vii. tt. 25 (*Bigaradia sinensis*) 32, 34 (*Bigaradia* var. *violacea*); 36 (*Bigaradia bizarre*); Tuss. Ant. iii. t. 15 (Bigaradier Franc); Wagner, Pharm. Med. Bot. tt. 49, 50 (*C. Aurantium*); Drapiez, Herb. Amat. de Fleurs, i. t. 56 (var. *violacea*); Steph. and Ch. Med. Bot. t. 14; Wight, Spicil. Neilgh. i. t. 25 (*C. vulgaris*); Wight, Ic. Pl. Ind. or. i. t. 957 (*C. vulgaris*); Berg and Schmidt, Darst. and Beschr. Pharm. iv. t. 31e (*C. vulgaris*); Risso and Poiteau, Orangers tt. 30–52; Köhler, Med. Pflan. i. (*C. vulgaris*); Bonavia, Cult. Orang. and Lem. India, tt. 1–18.

Bitter Orange; Seville Orange; Bigarade Orange.

Old Calabar; and in many other parts of the Colony.

In 1898 some good varieties of the sweet orange were purchased through the Royal Botanic Gardens, Kew, from Messrs. T. Rivers and Son, Sawbridgeworth. The collection included "Jaffa," "Tangerine," "St. Michael's," "Egg" (St. Michael's), "Embiguo," and "Maltese Blood." Messrs. Elder, Dempster & Co. conveyed the plants free from Liverpool. The plants arrived in excellent condition, and in 1900 they were with one exception going on well. The St. Michael's fruited in 1908 (Williams, Plant List, Old Calabar, 1909).

Orange plants are sold by the Botanical Department at Oloke-Meji, price 1*d.* per plant (S. Nigeria Govt. Gaz., March 24th, 1909, p. 458).

There are other well marked varieties readily distinguishable by the white flowers, and oblate spherical fruits which are characteristic of them all :—"Bergamot" orange (*C. Aurantium*, var. *Bergamia*) ; "Portuguese" orange (*C. Aurantium*, var. *lusitanica*) ; "Blood Orange," "Maltese Blood," (*C. Aurantium*, var. *melitensis*), and "Kumquat" (*C. Aurantium*, var. *japonica*).

There are also many cultivated forms, chief amongst which are "Jaffa," "Embiguo," "St. Michael's," "Mediterranean Sweet," "Majorca," "Navel," &c. Dr. W. C. Stubbs records 83 sorts (The Orange and other Citrus Fruits, p. 27), or including his list of Mandarins and Tangerines (*Citrus Aurantium*, var. *nobilis*) 92.

According to Colby (California Oranges and Lemons, p. 103) the "Navel" is the largest of all oranges, although in the proportion of skin to flesh it has no advantage over either the "Mediterranean Sweet" or "St. Michael's." The average "Navel" has nearly 72 per cent. of flesh, the "Mediterranean Sweet" and "Maltese Blood" 72 per cent., and "St. Michael's" 80 per cent. Of a number of varieties examined by him for juiciness, "Navel" orange was the driest, "St. Michael's" had the largest proportion of juice, followed in proportion by "Mediterranean Sweet" and "Maltese Blood."

"Tim Kom" is said to be the best orange in China ; it sells in Hong Kong at 13 c. per lb. (Agric. News, Barbados, 1906, p. 100).

"Satsuma," a seedless Japanese orange, is, according to Stubbs (l.c. p. 37), the hardiest of all oranges.

The orange is perhaps the most popular of the tropical fruits that come into the markets of the United Kingdom. The sweet orange as a dessert fruit, and the Seville or bitter orange for making marmalade and candied peel are well-known uses. The dried orange peel (Aurantii Cortex of the British Pharmacopoeia) is an aromatic tonic. Following the applications for dessert, preserves, and medicinal purposes, there are three essential oils produced : "Bergamot Oil," obtained from the fresh green peel of the Bergamot orange, "Oil of Neroli," from the fresh flowers of the sweet and bitter oranges, obtained by distillation, and "Orange Oil" from the fresh peel of the same, obtained by expression or by the "Ecuelle" (sponge) process. The latter is remarkable in possessing the highest optical rotation of all essential oils ; it ranges between + 96° and + 98° at 20° C. in 100 mm. tube (Schimmel & Co. Semi-Ann. Rep. October, 1896, p. 48). The rotation of Neroli oil (sweet orange flowers) is given as + 16° to + 29°, that of Neroli oil (bitter orange flowers) as + 10°, and that of bergamot oil + 9° to + 15°, all at 20° C., and in 100 mm. tube (l.c. April, 1897, p. 34). The yield of Neroli oil has been given as 0·1 per cent., according to Schimmel (l.c. p. 34), and 0·6 to 0·7 from flowers of the bitter orange, and half the amount from flowers of the sweet orange, according to Poiteau and Risso (Hist. Nat. des Orangers, p. 211). The yield of bergamot oil is 2½ to 3 ozs. from 100 fruits (Flückiger and Hanbury Pharmacogr. p. 122). The market price of bergamot oil is 17*s.* to 20*s.* 6*d.* per lb. (Chem. and Druggist, April 17th, 1909, p. 608), that of sweet orange oil 7*s.* 2*d.* to 8*s.* 10*d.* per lb., and that of bitter orange oil 7*s.* 7*d.* to 8*s.* 6*d.* per lb. (l.c. p. 609).

Essence of bergamot comes largely from Messina and Palermo, and its chief use is in perfumery. The flower oils come chiefly from the South of France (Grasse, Cannes, and Nice) ; the use is almost confined to perfumery, for which purpose the oil from the bitter orange flowers is considered the best. The peel oils are used in perfumery and for liqueur making. Orange oil deteriorates by keeping unless kept in air-tight vials, in cool dark rooms.

Other products that may be mentioned are "Orange Flower Water," the water remaining after the removal of the oil of Neroli after distillation. It is used in medicine to give an agreeable odour to various preparations. "Essence of Petit Grain," originally obtained by distillation from small immature oranges, but now produced from the leaves and shoots of the bitter and sweet oranges, is used in perfumery and in the manufacture of Eau de Cologne.

The wood is described as heavy, hard, strong, of very close grain, and susceptible of a smooth polish, of a light lemon yellow colour, little difference being seen between the heart-wood and sap-wood ; admirably suited for turnery (Hough, American Woods, v. No. 103, p. 25). The young saplings make good walking sticks (Mus. Kew).

Oranges may be propagated from seed, by cuttings, layering, budding and grafting. The raising of orange trees from seed has often been a subject of discussion, based on the question of their breeding true or otherwise. Seeds germinate readily. They should be selected from the best fruits, and sown immediately after removal from the fruit ; to preserve the seeds until sown Lelong advises keeping them in moist sand (Citrus and Deciduous Trees from Seed, p. 8).

To maintain a certain stock without variation the best methods are budding and grafting.

The stocks may be either the sweet orange itself ; the bitter orange ; grape fruit (*Citrus decumana L.*, var. "Grape Fruit"), Lime (*Citrus medica*, var. *acida* and var. *limetta*), or Citron (*Citrus medica*). They may be budded at anything from 2 or 3 inches to a foot from the ground.

Some experiments in budding have been carried out at Oloke-Meji, the bitter orange being used as a stock for buds of the Navel

Orange and Grape Fruit. The results with the Navel Orange were not (1906) satisfactory, but the Grape Fruit was very successful (Williams, Rep. Bot. Dept. Oloke-Meji, 1906, in S. Nigeria Govt. Gaz. Dec. 11th, 1907, p. 16).

The sweet lime and citron are used in India. Trees on the sweet lime stock have sweeter fruits with thin adherent skins, while those on the citron stock have loose jacketed fruits, come into bearing more quickly, and have a somewhat longer life. The seedlings are ready for budding when about two years old, at which time they are about 2 feet high. Planted out a year or so later they bear fruit in the fourth year from budding (Agric. Journ. India, January, 1907, p. 64).

At the Orange Conference (*see* Bull. Bot. Dept. Jamaica, 1902, p. 8) in Jamaica, December, 1901, the best stock was considered to be the Seville orange.

Seedlings when about 18 inches high (six months old) were transplanted from the nursery beds to distances of 4 feet by 13 feet, or 7,000 trees per acre. Budded three months later, or when nine months old, they were considered ready for planting out in permanent places when 15 to 18 months old.

The common sour orange for budding the better sorts has also been recommended in Dominica as being the most vigorous and better able to resist "collar rot" or "mal-di-gomma" (Hesketh Bell, Cult. of Orang. Dominica, Pamph. No. 37, 1905, Imp. Dept. of Agric. W. Indies, p. 22). The same system has also been adopted in Jamaica.

According to Stubbs (The Orange and other Citrus Fruits, pp. 19–20) the choice of sweet or sour orange stock resolves itself into a question of "mal-di-gomma" or no "mal-di-gomma." This disease he states "has caused the abandonment of sweet stock in all the orange-growing districts of Europe"; and that "it invariably appears sooner or later in every orange-growing district where sweet stock is used." He also states that "the sour stock has the objection of frequent attacks when in the nursery of 'leaf scab,' though when once budded all danger is over, as the sweet top is proof against the disease."

Apart from the uncertainty of fruit developed from seeds in the first instance, the liability of the sweet orange to "foot rot," "stem rot," "collar rot," "sore shin," or "mal-di-gomma," as the disease is variously called, should be a sufficient objection to its use as a stock, giving preference to that of the more reliable sour orange for this purpose, and perhaps other stocks, the merits of which I am here unable to discuss.

Grafting does not appear to be nearly so generally practised as budding, although the orange is regarded as an easy subject on the usual principles. The Sicilians and Calabrians bud their trees, and adopt "grafting by approach" as a secondary measure. (*See* Cons. Rep. Ann. Ser., No. 1770, Palermo, 1896, p. 30, where the budding is described as the "Scutcheon Method of Grafting.")

A rich deep soil, with thorough drainage, is essential to success in orange cultivation. More attention should perhaps be given to the physical condition of the soil than to its chemical constituents, although it is advisable to avoid soils containing salt. Irrigation may at times be necessary.

Any distance apart, from about 12 to 20 feet, may be required by the trees at maturity.

Due regard to pruning, tillage, manuring, and thinning the fruits are points of which a skilled cultivator need not be reminded In pruning the well regulated head with open centre ; in tillage light surface forking in order not to injure the roots ; and in manuring care not to induce rank growth at the expense of fruit.

It has been observed in Dominica that " the use of pen manures for citrus trees results in increasing the size of the fruit at the expense of the texture, and orange trees bear fruits of enormous size with very thick skins, woody pulp and little flavour " (Agric. News, Barbados, 1904, p. 100).

According to analyses, which show much variation in the composition of the fruits investigated by V. Olivieri and F. Guerrieri (Staz. Sper. Agric. Ital. 28, 1895, No. 5, pp. 287–301), the following fertilizer is recommended for citrus fruits in general in the province of Palermo ; muriate of potash, 900 gm. ; Thomas [basic] slag, 1,000 gm. ; and sulphate of ammonia, 3,530 gm., for each tree. (*See* Exp. St. Record, U.S. Dept. of Agric. vii. 1895–96, p. 582.)

A fertilizer containing two parts of potash, one of phosphoric acid and two of nitrogen is recommended in Louisiana for bearing trees (Stubbs, The Orange and other Citrus Fruits, p. 26).

In the Botanical Gardens, Oloke-Meji, Nagpur oranges have been grown from seeds imported from India, and are reported (1908) to be doing well (Col. Rep. Misc. No. 51, 1908, p. 47). The Nagpur orange has a good reputation, and the strain is kept true by budding. In five years from the time of planting the trees are said to give a full crop, which continues for some eight to ten years, after which the yield gradually lessens, and new plantations are recommended. The tree averages in Nagpur a height of about 16 feet, and the average number of fruits borne by a tree in full bearing is estimated at about 1,000 (Joshi, Agric. Journ. India, January, 1907, p. 67).

The annual production in Porto Rico from trees five years old has been given at 35,000 oranges per acre (70 trees per acre) or 500 oranges per tree. These figures, according to Spons' Encyclopaedia, (p. 1026) are equal to the average annual yield per tree in Jamaica, and the Neapolitan Provinces, increasing sometimes to 1,000 and even 2,000 per tree.

Jamaica oranges in London realize 6*s*. to 9*s*. per box, and Florida oranges in New York $1.50 to $2.00 per box (Agric. News, Barbados, April 3rd, 1909, p. 112). The total imports of oranges into the United Kingdom from all sources during 1907 were 6,120,185 cwts., value £2,454,569 ; the greater proportion was contributed by Spain (5,303,525 cwts., value £1,994,339), the remainder coming from Turkey (Asiatic), Italy, B. W. Indies, U.S. America, Egypt, Portugal, France, Germany, Azores, Australia, Malta and Gozo, Canary Islands and Natal (Trade of the United Kingdom, 1908, p. 179).

Ref.—"Some Remarks on the Genus Citrus, cultivated in Jamaica," Dr. Macfadyen, in Hooker's Bot. Miscell. 1830, pp. 295–304.—On the Introduction, Cultivation and Economic Uses of the Orange, and others of the Citron Tribe in N.S. Wales, Dr. Bennett, pp. 1–35; Reprint from the Indust. Progress of N.S. Wales, Inter. Col. Exhib. Sydney, 1870, pp. 663–697 (Govt. Printer, Sydney, 1871).—Histoire et Culture des Orangers, Risso and Poiteau, pp. 1–228, with 109 large coloured plates (Henri Plon and G. Masson, Paris, 1872).—"Products of the Orange Family," in Tropical Agric. Simmonds, pp. 438–448 (E. & F. N. Spon, London, 1877).—"Oleum Bergamottae" (*Citrus Bergamia*, var. *vulgaris*, Risso), History, Production, Description, Chemical Composition, Commerce, Uses, Adulteration, in Pharmacographia, Flückiger and Hanbury, pp. 121–124 (Macmillan & Co., London, 1879).—"Oleum Neroli" (*Citrus vulgaris*, Risso), l.c. pp. 126–128.—"Cortex Aurantii" (*Citrus vulgaris*, Risso), l.c. pp. 124–126.—"*Citrus vulgaris*" (Bitter orange, Seville orange, Bigarade orange), in Med. Pl. Bentley and Trimen, No. 50, 3 pages (Churchill, London, 1880).—"Citrus Aurantium" (Sweet orange, China orange, Portugal orange), l.c. No. 51, 5 pages.—"Citrus Bergamia" (Bergamot), l.c. No. 52, 5 pages.—"Oranges," in Spon's Encycl. Div. iii. 1881, pp. 1025–1027.—The Cultivated Oranges and Lemons, etc., of India and Ceylon, Dr. Bonavia, pp. 1–365, with an Atlas containing 259 plates (W. H. Allen & Co., London, 1890).—Citrus Fruits, Garcelon and Lelong, pp. 1–38, with analyses of the Orange (Supdt. State Printing, Sacramento, 1891).—"Orange Scale" (*Aspidiotus Aurantii*), in Kew Bull. 1891, pp. 221–230, with plate.—"California Oranges and Lemons," Colby, in Rep. 1891–2, Agric. Exp. St. Univ. of California, pp. 99–113, giving tabulated proximate analyses of 18 samples of Oranges and nine samples of Lemons; a continuation of Bull. No. 93, 1891, of the Agric. Station.—The Rearing of Citrus and Deciduous Trees from Seed, Lelong, pp. 1–38; Orange Propagation from Seed, p. 8; Budding the Orange, p. 19; figs. 10–15 (Supdt. State Printing, Sacramento, 1892).—"The Orange" in Tropical Agric. Dr. Nicholls, pp. 144–153 (Macmillan & Co., London, 1892).—Treatise and Handbook of Orange Culture in Florida, Louisiana and California, Rev. J. W. Moore, pp. 1–189 (Pelton & Co., New York; Kegan Paul, Trench, Trubner & Co., Ltd., London, 1892).—The Orange and other Citrus Fruits, Dr. Stubbs, pp. 1–110, with nine figures illustrating budding, and dealing with the botany, methods of propagation, comparative methods of the different kinds of stock, planting and growing, composition of oranges and lemons, fertilizers for the orange, and list of varieties of the orange, lemon, shaddock, pomelo or grape fruit, citron, cumquat, &c., including a report by Prof. Morgan on the Scale Insects of the Orange, illustrated (Bureau of Agric. Louisiana, 1893).—Cultivo y Exploítacion del Naranjo, F. Atristain, in Boletin de Agric. Mineria é Industrias, Mexico, April, 1894, pp. 1–46.—"Orangers," in Les Cultures sur le littoral de la Méditerranée, Dr. Sauvaigo, pp. 249–259 (Baillière et Fils, Paris, 1894).—"Citrus Aurantium," in The American Woods, Hough, v. No. 103, pp. 25, 26, with sections—transverse, radial, and tangential—of the wood (Published by the Author, Lowville, New York, 1894).—"Jaffa Orange," in Kew Bull. 1894, pp. 117–119.—"Orange Growing in Florida and Jamaica," l.c. 1895, pp. 125–126.—“Oranges and Lemons,” in Dip. and Cons. Rep. Ann. No, 1544, 1895, an Account of the Orange and Lemon Industry in Sicily; extract in Kew Bull. 1895, pp. 266–271; abstract in Journ. Soc. Arts, xliv. 1896, pp. 279–282.—“Essential Oils of the Orange,” in Bull. Bot. Dept. Jamaica, 1895, pp. 177–180.—“Effects of Fertilization on Citrus Fruits,” Colby & Hilgard in California Sta. Rep. 1895–1897, pp. 163–181.—“Methods of Propagating the Orange and other Citrus Fruits,” Webber, in U.S. Dept. Agric. Year Book, 1896, pp. 471–488; with 13 figures. Reprint in Bull. Bot. Dept. Jamaica, 1898, pp. 75–87.—“Reproduction of the Orange from Seed,” Webber, in Gard. Chron. June 27th, 1896, pp. 784–785; July 4th, p. 10.—“Condition and Treatment of Orange Groves,” Moremen, in Bull. No. 33, 1896, Florida Agric. Experiment Station, pp. 209–236.—“Report on the Cultivation of Oranges, Lemons, Citrons, and Bergamots, as practised in Sicily and the Calabrie, in Dip. and Cons. Rep. Ann. No. 1770, 1896, pp. 26–48; dealing with the seed plot, nurseries, grafting, plantation, association of fruit and vegetables or cereals, pruning, manuring, gathering the fruit, defects and diseases, manufactured products, from the timber, leaves, flowers and fruit.—The Principal Diseases of Citrus Fruits in Florida, Swingle and Webber, Bull. No. 8, 1896, U.S. Dept. of Agric. pp. 1–40, illustrated.—Sooty Mould of the Orange and Its Treatment, Webber, Bull No. 13, 1897, U.S. Dept. of Agric. pp. 1–34, illustrated.—“Citrus Aurantium,” in Dict. Econ. Prod. India, Watt, ii. 1899, pp. 335–348.—‘Budding Orange Trees,” Cradwick, in Bull. Bot. Dept. Jamaica, 1900, pp. 169–172, fig. i., describing the preparation of lemon, shaddock, and large sour orange trees for budding, the condition of the trees from which sweet orange buds are taken, and methods of budding.—“Orange Culture and Diseases in Malta,” Borg, in Bull. Bot. Dept. Jamaica, 1900, pp. 129–142.—Culture of the Citrus in California, Lelong, pp. 1–260, illustrated (Supdt. State Printing, Sacramento, 1900).—“The Cultivation of Oranges,” Senor Alino, in Journ. Roy. Hort. Soc. xxv. 1901, pp. 341–352, dealing entirely with manuring; Summary in West Indian Bull. iii. 1902, pp. 230–233.—“The Cultivation of the Jaffa Orange,” in Journ. Soc. Arts. xlix. 1901, p. 639.—Orange and Lemon Rot, Woodworth, Bull. No. 139, 1902, Agric. Exp. St. Univ. of California, pp. 1–12, illustrated (Supdt. State Printing, Sacramento, 1902).—Red Spider of Citrus Trees, Woodworth, Bull. No. 145, 1902, Agric. Exp. St. Univ. of California, pp. 1–19, illustrated (The Univ. Press, Berkeley, 1902).—“Orange Conference,” in Bull. Bot. Dept. Jamaica, 1902, pp. 1–25, dealing with varieties; situation for grove; propagation; treatment in grove; insect and other pests.—Propagation and Marketing of Oranges in Porto Rico, Henricksen, in Bull. No. 4, 1904, Porto Rico Agric. Exp. Station, pp. 1–24, including details of propagation by seeds and budding; planting a grove, working over old trees; by crown grafting, top grafting, top budding, dormant budding, inarching and bridge grafting; marketing; picking and curing, grading, sizing, packing, and shipping; with illustrations of the various methods of budding and grafting (6 plates), and figures in the text of pruning and budding tools, grafts covered up, orange sizer, and method of packing oranges.—Wither Tip and other Diseases of Citrous Trees and Fruits, Rolfs, Bull. No. 52, 1904, U.S. Dept. of Agric. Bureau of Pl. Industry, pp. 1–20; plates i–vi.—Cultivation of Oranges in Dominica, Hesketh Bell, Pamphlet No. 37, 1905, pp. 1–52; issued by the Commissioner, Imp. Dept. of Agric. W. Indies (Dulau & Co., London); Abstract in Journ. Soc. Arts, liii. 1905, pp. 901–904.—"Orange Trees," in Journ. Jamaica Agric. Soc. October, 1906, pp. 390–394.—Citrus Fruit Growing in the Gulf States, Rolfs, Farmers' Bull. No. 238, 1906, pp. 1–48, illustrated (Govt. Printing Office, Washington, D.C., 1906).—"Orange Cultivation in the Central Provinces," R. S. Joshi, Rai Bahadur in Agric. Journ. India, January, 1907, pp. 64–69. pls. viii. and ix.—Citrus Fruits and their Culture, Hume, pp. 1–587; illustrated (Orange Judd Co., New York, 1907).—"A Treatise on Citrus Culture from Seed to Fruit"; shewing the Influence of the Stock, Masters, in The Agric. Journ. Cape of Good Hope, xxx. 1907, pp. 155–172; pp. 307–325; pp. 437–453; pp. 605–630; and pp. 751–763, illustrated.—The Decay of Oranges while in transit from California, Powell, in Bull. No. 123, 1908, U.S. Dept. Agric. Bureau Pl. Ind. pp. 1–79, with 9 plates shewing orange groves; packing house; brushing, sizing and washing machines, &c.; 26 figures in the text.—"The Citrus Fruit Industry of California," in Journ. Soc. Arts, lvi. 1908, pp. 798–799.—"Essential Oils" from citrus fruits, sweet oranges, Seville oranges, limes and lemons, with particulars of orange rinders (15*s.* to 20*s.* each), in Journ. Jamaica Agric. Soc. December, 1908, pp. 410–412.—"Gum Disease of Citrus Trees in California," Smith & Butler, in Bull. No. 200, 1908, Agric. Exp. St. Univ. of California, pp. 236-270, illustrated (Supdt. State Printing, Sacramento, 1908).

Citrus decumana, *Murr.* Syst. ed. xiii. (1774) p. 508.

A small tree, 20 feet high and upwards, branches spreading, spiny, sometimes spineless; young shoots pubescent; leaves, ovate, obtuse, or emarginate, pubescent on the under side, petiole broadly winged; flowers white; fruit large, sometimes several pounds in weight, globose or pyriform, pale yellow, rind thick, pulp pale, pink or red, sweet or acid, vesicles easily separated.

Ill.—Rumpf, Amb. ii. t. 24; Duhamel, Traite des Arbres, vii. tt. 38, 42; Tuss. Ant. iii. tt. 17, 18; Nooten, Fl. Java, t. 3; Risso and Poiteau, Orangers, tt. 61–66; Nicholson, Dict. Gard. f. 461; Bonavia, Cult. Oranges and Lemons, India, tt. 59–92; Garden and Forest, April 22nd, 1896, p. 163, ff. 23 and 24 (Fruit of Pumelow or Shaddock), f. 25 (Grape Fruit, as sold in New York), f. 26 (Forbidden Fruit, as sold in New York); Hume, Pomelos, tt. 1–7; Freeman and Chandler, World's Comm. Prod. p. 277.

Shaddock (Western Tropics); Pumelo (Eastern Tropics); Pampelmouse (French); Giant Citrus; Forbidden Fruit; Grape Fruit (from the fruit growing in clusters like grapes).

Tropical Asia, Malayan and Polynesian Islands; commonly cultivated in India, West Indies, Tropical America, &c.

The Shaddock fruited in the Botanic Garden at Old Calabar in 1899, the tree being then about 5 years old. Several plants of "Grape Fruit" were received at Old Calabar in April, 1897, from the Royal Botanic Gardens, Kew. Young plants of this

Citrus may now be obtained from the Botanical Department Oloke-Meji at the rate of 1*d.* per plant (S. Nigeria Govt. Gaz. March 24th, 1909, p. 458).

Shaddocks, Pomelos, or Grape Fruits find a ready sale in America, and their popularity in this country is increasing. The fruits are regarded as more wholesome, more refreshing, and of greater medicinal value than those of the orange or citron, having been recommended by the medical faculty for their tonic properties, and as a specific for dyspepsia.

Hume has enumerated 15 varieties of Pomelo; dividing those described according to strength of flavour: "De Soto," "Duncan," "Excelsior," "Hall," "Josselyn," "Manville," "McKinley," "Pernambuco," "Standard," and "Walters," have the flavour pronounced; the "Triumph," and "Marsh" are not so characteristic, but both are very desirable; "Aurantium," "Royal," and "Nocatee" cannot be classed as characteristic Pomelos, and all are probably hybrids. The characteristic pomelo flavour is described as a pleasant commingling of bitterness, sweetness, and acidity. Classifying according to size, "De Soto," "Duncan," "Excelsior," "Hall," "McKinley," "Pernambuco," "Standard," and "Walters" rank as large (4–5 inches diam. approx.); "Triumph," medium (3–4 inches diam. approx.); "Josselyn," "Aurantium," "Royal," and "Nocatee," small (2–3 inches diam. approx.) (Pomelos, Bull. No. 58 1901, Florida Exp. St. pp. 392–402).

The Grape Fruit of Barbados is *Citrus paradisi*, Macfad., var. *pyriformis*; and the Forbidden Fruit, *Citrus paradisi*, Macfad. (Bot. Misc. Hooker, i. 1830, p. 304) now referable to the above species. Morris states that the term "grape-fruit" has become so general that any moderately large fruit, provided the skin is pale-yellow, thin, and smooth, and the pulp of a delicate flavour, is designated by it, and that the fruit commonly called grape-fruit in New York is really the forbidden fruit of the West Indies (West Indian Bull. vi. 1905, p. 286).

The best kind in India, according to Bonavia, is the red pumelo of the Bombay markets; it is globose, thin-skinned, juicy, and has pulp of the color of raw beef (Cult. Orang. and Lem. India, p. 167).

The cultivation of this group will be much the same as that of the orange, but unlike this, according to Macfadyen (Bot. Misc. Hooker, i. 1830, p. 304), the best shaddocks are observed to grow in the wet districts. Against this view, however, according to Stubbs (The Orange and other Citrus Fruits, p. 45) the shaddock is said to be unable to withstand the action of water about its roots, and to have a tendency to "sore shin," for which reasons it is not recommended as a stock for budding purposes. Opinions also vary as to the value of grape fruit as a stock; in Florida it is held in high esteem, and is much used; others regard it as being as tender as that of the sweet orange (l.c.). "Grape Fruit" has been budded very successfully on stocks of the bitter orange, at Oloke-Meji (Williams, Rep. Bot. Dept. Oloke-Meji, 1906, in S. Nig. Govt. Gaz. Dec. 11th, 1907, Suppl. p. 16).

Grape Fruits sell in London at 5*s.* 6*d.* to 9*s.* per box, and in New York at \$1·50 to \$2·25 per box (Agric. News, Barbados, April 3rd, 1909, p. 112).

Ref.—"The Coming Fruit," in Gardeners' Chronicle, July 11th, 1896, p. 46.—"Grape Fruit and Shaddock," Sir D. Morris in Garden and Forest, New York, April 22nd, 1896, pp. 163–164; reprinted in West Indian Bull. vi. 1905, pp. 284–287; and in Bull. Bot. Dept. Jamaica, February, 1906, pp. 36–38 (*See* also pp. 39–44 of this Bulletin); Summary in Agric. News, Barbados, 1905, p. 357.—*Ibid.* in West Indian Bull. vi. 1905, pp. 284–292 (Dulau & Co., London).—"Pomelos," Hume, in Bull. No. 58, 1901, Florida Agric. Exp. Station, pp. 385–421, with 4 figures in the text, and plates i. to viii., illustrating many of the sorts abovementioned, giving a description of the tree and varieties, analyses, and information on fertilizers (The H. & W. B. Drew Co., Jacksonville, Fla. 1901).—"The Pomelo," in U.S. Cons. Rep. September, 1905, Washington, pp. 101–103, giving particulars of the cultivation of the "Chinese Grape Fruit," and its introduction to the United States.

Citrus Medica, *Linn.* Sp. Pl. (1753) p. 782.

A small tree. Leaves large, serrated; petioles without wings. Flowers pink, or purplish in bud. Fruit large, 4 inches long and upwards, ovate, with a protuberance at the tip; pulp white, acid; rind yellow, thick, firm, irregular in outline and surface; sometimes lobed like fingers.

Ill.—Duhamel, Traite des Arbres, vii. t. 22; Desc. Ant. i. t. 7; Wagner, Pharm. Med. Bot. tt. 47, 48; Guimpel, Abbild. Beschr. t. 70; Drapiez, Herb. Amat. de Fleurs, vii. t. 491; Pereira, Mat. Med. ii. f. 393; Risso and Poiteau, Orangers, tt. 96–107; Bentl. and Trimen, Med. Pl. t. 53; Nicholson, Dict. Gard. f. 463; Bonavia, Cult. Oranges and Lemons, India, tt. 139–177; Gard. Chron. February 13th, 1904, p. 101, f. 45 (fruit).

Vernac. name.—Osan Lakuregbe (Lagos, *Dawodu*).—Citron.

Cultivated in Palestine, Italy and other parts of S. Europe.

The chief use is for the rind or peel, usually imported into this country in a salted state, and afterwards candied for dessert and confectionery purposes.

Plants of the Citron were sent out from Kew to Nigeria in 1898, and young plants may now be obtained from the Botanical Dept. at Oloke-Meji (*See* S. Nigeria Gazette, March 3rd, 1909, p. 308).

Ref.—"Citrus Medica," in Medic. Pl. Bentley and Trimen, No. 53.—"The Citron in Commerce," Kew Bull. 1894, pp. 177–182.

Var. **acida**, *Brandis.*

A small spiny tree. Leaves oval; petioles winged linear or obovate. Flowers white. Fruit globose, about $1\frac{1}{2}$ to two inches in diam., with a blunt protuberance; pulp pale, acid.

Ill.—Rumpf, Amb. ii. t. 29 (Limonellus or Limotenuis, thin-skinned lemon); Wight, Spicil. Neilgh. t. 26 (*C. Limonum*); Wight, Ic. Pl. Ind. or. t. 958 (*C. Limetta*); Bot. Mag. t. 6745;

Bonavia, Cult. Oranges and Lemons, India, tt. 225–233 ; Kew Bull. 1894, p. 116 ; Agric. News, Barbados, vii. 1908, p. 229 f. 5 (Ordinary Lime Tree), f. 6 (Spineless Lime Tree).

Vernac. name.—Orombe wewe (Lagos, *Dawodu*).—Lime ; Sour Lime.

Naturalized in Nigeria and Tropical Africa. Cultivated in the the West Indies (Jamaica, Montserrat, Dominica), and in many other tropical countries.

The fruit is invaluable for "Lime drinks" and flavouring, but beyond this nothing appears to be done with it in Nigeria. The commercial value of the lime is invested in the green fruits ; ripe fruits—pickled in salt or sea water ; raw juice ; concentrated juice ; oil obtained by pressure and by distillation, and citrate of of lime. The fresh and pickled fruits are an efficient substitute for the lemon, and the trade in them is one of growing importance, chiefly between the West Indies and the American and European markets, New York and London more directly.

The green fruits require to be gathered, handled, wrapped and packed as carefully as oranges, and the ripe yellow fruits intended for shipment are pickled by placing them in vats of sea water, which is run off and renewed at intervals of 2 or 3 days for several times ; they are then packed in casks of strong brine.

The raw juice, as used for making cordials and flavouring is carefully prepared from ripe fruits, by crushing in mills or otherwise, straining and filling into casks for export. To prevent fermentation, Nicholls (Trop. Agric. p. 157) recommends ½ an ounce of salicylic acid to 50 gallons of juice. A barrel of limes (1,400 to 1,600 fruits) yields 7½ to 8 gallons of juice (A. B. C. of Lime Cult. Imp. Dept. Agric. W. Indies, p. 25).

Concentrated juice is shipped entirely for the production of citric acid, the degree of concentration being about 10 per cent. of the raw product, reduced by boiling. A density of 60° as indicated by a citrometer (in the juice at boiling point) or when the specific gravity is 1·243 (ascertained by a specific gravity hydrometer) is considered the right degree. Further concentration is not considered profitable as it is liable to reduce the citric acid content. Seventy-five barrels of limes (about 120,000 fruits) produce 50 gallons of concentrated juice (l.c. p. 34).

Distilled lime oil or "Oil of Limes" is a by-product obtained in the preparation of the concentrated article. According to Gildemeister and Hoffmann (The Volatile Oils, p. 477) it is entirely different from the oil obtained by expression. Its odour is unpleasant, terebinthate. and does not remind one of citral ; the specific gravity is 0·865 to 0·868, and the boiling point between 175° and 220° ; the oil obtained from the peel of the fruit by expression, they describe as of a golden yellow colour, hardly distinguishable from good lemon oil by its odour ; its most important constituent is citral, and the specific gravity 0·873 at 29° C. to 0·882 at 15° C. A barrel of limes will give from 3–4½ ozs. of oil by expression, and 3–5 ozs. by distillation (Lime Cult. Pamph. 53, Imp. Dept. of Agric. W. Indies, p. 40).

Lime oil is used in perfumery and soap manufacture.

Distilled Lime Oil from the West Indies sold on the London market, April 1909, at 1*s*. 9*d*. to 1*s*. 11*d*. per lb. (Chem. and Druggist, April 24th, 1909, p. 656). Lime juice on the London market was realizing in March, 1909, 1*s*. 3*d*. per gallon for the raw product ; £18 per cask of 108 gallons for concentrated juice (Agric. News, Barbados, April 3rd, 1909, p. 112).

Lemons, limes and citrons are classified together in the Customs Returns, and the total amount imported into the United Kingdom in 1907, from Germany, Spain, Italy, West Indies, &c., was 882,193 cwts., value £421,599 (Trade of the Unit. Kingdom, i. 1908, p. 178). The Returns for lime and lemon juice are also figured together, and the total amount for 1907, chiefly from Italy (138,361 gallons, probably lemon, value £23,225) and British W. Indies (413,597 gallons, probably lime, £46,389) was 552,462 gallons, value £69,671 (l.c. p. 181).

The lime is usually raised from seed, which should be washed, dried, and sown as early as possible after removal from the fruit. The seedlings are ready for planting out in permanent places when about a foot or two high, in from 9 to 12 months after sowing. They may be planted from 12 to 20 feet apart, according to richness of soil or locality, but each tree should be subject to full sunlight at all times. The main requirements are a rich well-drained soil, sheltered position, and a rainfall approximating to 100 inches. In Dominica the best results are obtained on the rich coastal and valley lands, possessing a light black soil ; the plants are also said to succeed in comparatively shallow soils overlying heavy clays, and in red soil (Lime Cult. Pamph. 53, Imp. Dept. Agric. W. Indies, p. 7). The rainfall is stated to have an effect on the citric acid content and the yield of oil (from the rind)—60 to 100 inches increasing the former and lowering the latter, and 130 to 200 inches conducing to the reverse of these conditions (l.c. p. 40).

Protection from wind is important, and if there are no natural shelter belts of trees, or rising ground in the neighbourhood of the plantation, provision should be made by planting suitable trees. In Montserrat "White Cedar" (*Tecoma leucoxylon*) is used for this purpose, planted at distances of about 150 yards, either in single rows, or in double rows about 4 feet apart (l.c. p. 45). "Galba" (*Calophyllum Calaba*) in Dominica has been found suitable for main shelter belts, and Pois doux (*Inga laurina*) has been recommended for subsidiary hedges, the prunings of which make excellent mulch (l.c. p. 9).

Tillage, pruning, manuring, &c., much the same as for the orange ; although for manuring it has been recommended by Señor Aliño (Journ. Roy. Hort. Soc. xxv. 1901, p. 352) that from 10–12 per cent. more of nitrogenous fertilizer should be used.

The ordinary Lime is usually very spiny, but a spineless form has been developed in Dominica, which is considered superior in its bearing qualities and in the citric acid content of the fruits. (*See* Rep. Bot. St. Dominica, 1906–07, and Lime Cult. l.c. p. 4.)

The machinery required for dealing with lime-juice is a three-roller mill (the rollers made of granite when the juice is to be used for making cordial—iron may be used when the juice is to be concentrated), driven by steam, water, or cattle ; a press for extracting any juice that may be left in the skins after passing through the mill ; storage vats ; a copper still ; three copper tayches in which to boil the juice, and coolers. (*See* Lime Cult. Pamph. 53, Imp. Dept. Agric. W. Indies, p. 26, and for estimates of the cost of requirements totalling £305 for an estate of 10–12 acres, and £1,500 for an estate of 50–60 acres, p. 27.)

The extraction of citrate on the spot appears to be new outside Sicily and S. Italy, and other countries where it is produced from the Lemon, and it is not unlikely that the manufacture will supersede that of concentrated juice, especially when freight is an important consideration. In this connection it may be of interest to remember the artificial production of Citric Acid which a few years ago created some anxiety amongst cultivators of the Lemon and Lime. It was then (1894) stated by an eminent firm of wholesale pharmacists that, although it had certainly been produced, this was more as a scientific experiment, and it was not likely to become an article of commerce ; in other words, they did not believe that "an artificial would ever supersede the natural acid." (*See* Kew Bull. 1894, pp. 103–108, and pp. 199–200.) The progress of the synthetic product does not appear, so far, to have gathered any more force.

The preparation of "Citrate of Lime" is fully detailed in the Pamphlet No. 53, Imp. Dept. Agric. W. Indies, pp. 41–44. (*See* refs. below.)

Ref.—"The Lime Industry in Dominica," Dr. Nicholls, in Timehri, Demerara, ii. 1883, pp. 81–97. — "Lime Juice, Its Properties and Uses," Conroy, in Pharm. Journ. [3] xiii. 1883, pp. 606-608.—"On the Probable Source of the whole Group of Cultivated True Limes," Dr. Bonavia, in Journ. Linn. Soc. xxii. 1887, pp. 213–218.—"The Sour Lime of India," in Dict. Econ. Prod. India, Watt, ii. 1889, pp. 355–357.—"The Lime," in Tropical Agric. Dr. Nicholls, pp. 153–158 (Macmillan & Co., London, 1892). —"Limes," in Bull. Bot. Dept. Jamaica, Nov. 1892, pp. 11–12.—"West Indian Lime," in Kew Bull. 1894, pp. 113–116.—"Artificial Production of Citric Acid," l.c. pp. 103–108 and pp. 199–200.—"Distilling the Essential Oil of Limes," in Bull. Bot. Dept. Jamaica, 1895, pp. 97–98.—"Oil of Limette" (West Indian Limette Oil, *Citrus medica*, var. *acida* ; Italian Limette Oil, *Citrus Limetta*, Risso, distinguished from that of the W. Indian by its sweet juice), in The Volatile Oils, Gildemeister & Hoffmann, pp. 477–478 (Milwaukee Pharmaceutical Review Publishing Co., 1900).—"Cultivation of Limes in the West Indies," in West Indian Bull. ii. 1901, pp. 308–318.—"Citrate of Lime, preparation of," l.c. iii. 1902, p. 152. —"Concentrated Lime Juice" (ascertaining its strength by means of a hydrometer) l.c. v. 1904, p. 236.—"Citrate of Lime and Concentrated Juice," l.c. vi. 1905, p. 308.—"Citrate of Lime," l.c. vii. 1906, pp. 331–337.—"Citrate of Lime and Concentrated Juice," l.c. viii. 1907, pp. 167–172, with sketch-plan of a Citrate Factory.—"The West Indian Lime," Brooks, in Journ. Roy. Hort. Soc. xxxii. 1908, pp. 172–188, illustrated ; dealing with the History ; Cultivation ; Insect and Fungoid Pests ; Products ;

Improvement of the Lime, &c.—A. B. C. of Lime Cultivation, Pamphlet No. 53, 1908, pp. 1–48, issued by the Commissioner, Imp. Dept. Agric. W. Indies (Dulau & Co., London), covering the Cultivation; Products—Green Limes, Pickled Limes, Raw and Concentrated Lime Juice, Citrate of Lime, Hand-pressed Lime Oil, Distilled Lime Oil, &c.—The Lancet, March 28th, 1908, giving an analysis of the juice of the Lime, compared with that of the Lemon.—Various Papers in the Agric. News, Barbados.—*See alsc* various references under *Citrus Aurantium.*

Var. **limonum**, Brandis.

Small tree 8–10 feet. Leaves oval-oblong crenulated, petioles somewhat winged or without wings. Fruit elongated, with thin yellow rind which adheres to the acid pulp.

Ill.—Duhamel, Traite des Arbres, vii. tt. 27, 28; Woodville, Med. Bot. iii. t. 189 (*C. Medica*); Tuss. Ant. ii. t. 19 (Limonier ordinaire); Hayne, Darst. Beschr. Gewäche, xi. t. 27 (*Citrus Medica*); Burnett, Pl. Util. i. t. 8a; Berg & Schmidt, Darst. & Beschr. Pharm. iv. t. 31f; Risso & Poiteau, Orangers, tt. 70–95; Bentl. & Trimen, Med. Pl. t. 54; Zippel, Ausl. Handels, Nährpfl. t. 22; Köhler, Med. Pflan. i.; Bonavia, Cult. Oranges & Lemons, India, tt. 178–224; Sauvaigo, Les Cult. Medit. f. 108.
Lemon.

Cultivated in the Botanic Gardens of the Colony.

A large form "Metfords Lemon" (*see* Kew Bull. 1900, pp. 28–29), sent out from the Royal Botanic Gardens, Kew, is also grown. Largely cultivated in the Mediterranean Region, Spain, Portugal, Azores, and the Canaries.

The candied rind (Lemon Peel) is an important article of commerce, and grafting or budding on the bitter orange is advisable (Kew Bull. 1895, p. 271), otherwise the uses and cultivation are much the same as those of the Lime (*q.v.*). The method of curing the whole fruit is somewhat different.

Lemons are not allowed to ripen on the tree, but are stem cut just before they begin to show yellow. They are then piled or heaped on the floor in a dark, close room, and covered with blankets for forty-eight hours, which will cause them to sweat profusely. After being wiped dry they are put in single layers on shelves in a dark room, and left for a week or ten days until they begin to show a clear, straw colour. They should then be sized carefully, since they are sold by size, and packed like oranges, in boxes. Lemons so prepared for market will keep for months in a perfect condition, and there is no trouble about their going bad in the way oranges do (Journ. Jamaica Agric. Soc. Jan. 1906, p. 20).

To pickle lemons for export they are first cut in two and immersed in salt water for from three to eight days; they are then placed in casks with alternate layers of salt; salt water is then introduced to fill up the spaces and the cask closed up (Kew Bull. 1895, p. 271).

Lemons at Covent Garden, London, May 26th, 1909, were realizing 8*s.*–10*s.* per box of 300, and 9*s.*–12*s.* per box of 360 (Messina), and 17*s.*–23*s.* per case for fruit from Naples (Gard. Chron. May 29th, 1909, p. 356).

Ref.—"Fructus Limonis," in Pharmacographia, Flückiger & Hanbury, pp. 114–118; "Oleum Limonis," pp. 118–121 (Macmillan & Co., London, 1879).—"Citrus limonum," in Medicinal Pl. Bentley & Trimen, No. 54 (Churchill, London, 1880).—"Fifteen years with the Lemon," Garcelon, in Citrus Fruits, part i. pp. 1–17. (*See* ref. under *C. Aurantium*).—"Citrus Fruits in Sicily"; Commerce; Cultivation; Extracting Essence and Lemon Juice; Production; Packing, &c., in Kew Bull. 1895, pp. 266–271.—"Metford's Lemon," l.c. 1900, pp. 28–29.—"On the Cultivation of Lemons within the Tropics," Dr. Neish, in Journ. Jamaica Agric. Soc. July, 1901, pp. 275–281.—The Brown Rot of the Lemon, Smith, Bull. No. 190, Agric. Exp. St. Univ. of California, pp. 1–72, illustrated (Supdt. State Printing, Sacramento, 1907).—"Curing the Lemon," in Agric. Journ. Cape of Good Hope, xxxii. 1908, pp. 220–223, with illustrations of Cured and Uncured Lemons; Curing Sheds and Packing House; Single Grader Machine, and Fruit Brushing Machines.—*See also* various references under *C. Aurantium* and *C. Medica* var. *acida.*

AEGLE, Corr.

Aegle Barteri, *Hook. f.* ex. Oliv. in Ic. Pl. t. 2285.

A small tree. Branches spiny; spines straight, slender, axillary, shorter than the petioles. Leaves trifoliolate; leaflets shortly stalked, obovate or elliptic, papery, pellucid-dotted. Racemes 1–2-in. long. Stamens 15–20, inserted outside a lobed disc. Ovary 8-celled, cells many-ovuled; stigma subsessile, oblong. Fruit spherical, 3–4 in. in diameter; pericarp woody ¼-in. thick. Seeds very numerous, much flattened.

Ill.—Hook. l.c.

Ogbomosha, Abeokuta and Oyo, in W. Prov. S. Nigeria.

The hard shell of the fruit is used for making calabashes (Barter, Herb. Kew).

A shade tree, Ogbomosha (Rowland, Herb. Kew).

SIMARUBEAE.

HANNOA, Planch.

Hannoa undulata, *Planch.*; Fl. Trop. Afr. I. p. 309.

Ill.—Guillem. Perr. Rich. Fl. Senegamb. t. 34 (*Simaba ? undulata*).

Vernac. name.—Igbo Lagos, (*Dawodu*).

Niger; Lagos; Nupe.

In French Guinea the oleaginous kernel is used by the natives for making soap, and the light white wood for firewood (Pobéguin, Fl. Guin. Franç. p. 47). Used for fever in Lagos (Dawodu, Herb. Kew).

IRVINGIA, Hook. f.

Irvingia Barteri, *Hook. f.*; Fl. Trop. Afr. I. p. 314.

Il.—Hook. Ic. Pl. t. 1246; Ann. Inst. Col. Marseille, 1893, t. 4 (*I. gabonensis*); Ann. Fac. Sc. Marseille, iii. 1893, t. 13 (*I. gabonensis*); Engl. & Prantl, Pflan. iii. pt. 4, f. 132 (*I. gabonensis*); Thonner, Blütenpfl. Afr. t. 75; Drabble, in Journ. A–H Inst. Comm. Res. Tropics, Liverpool Univ. Jan. 1908, p. 20 (Seeds *I. gabonensis*.)

Vernac. names.—Oro (Lagos, *Rowland*, *Dawodu*, *Millen*); Oro (Yoruba *Moloney*); Okerli (Benin, *Unwin*); O'Dika, Dika, or Udika (Gaboon, *Heckel*, *Mann*); Iba or Oba (M'Pongwé, *Heckel*); N'Dogo or Endogo (Pahouin, *Heckel*); Ndisok (Old Calabar, *Holland*); Ujio (*Drabble*).—Dika Bread; Dika Nut; Gaboon Chocolate; Wild Mango.

Abeokuta; Lagos; Yoruba; Asaba; Old Calabar; Cross River, and throughout W. Africa.

The fruit is edible, in flavour somewhat like the ordinary Mango (*Mangifera indica*) but very inferior. The natives eat it, but they attach greater importance to the kernel, from which they make the so-called "Dika" or "Udika" bread, which consists of the bruised kernels warmed and pressed into a cake. It is used largely, when scraped or grated, in stews, and, in general, forms a staple article of food amongst the natives (Mus. Kew). Dika bread is sometimes mixed with the roasted seeds of *Pentaclethra macrophylla* (Mus. Kew) and *Fegimanra africana* (Drabble, Journ. Inst. Comm. Res. Tropics, Liverpool Univ. Jan. 1908, p. 20).

Lewkowitsch finds decorticated seeds—sun-dried kernels—from S. Nigeria to contain 54·3 per cent. of solid fat, having a specific gravity of 0·914 at 40° C.; melting point 38·9° C.; saponification value 244·5; iodine value 5·2 (Year Book of Pharm. 1906, p. 30). The fat is considered suitable for soap and candle-making, for which purposes its value is regarded as equal to that of Palm-kernel oil—£27 5*s.* per ton (Bull. Imp. Inst. 1908, p. 375, where a complete analysis is given)—and if it could be obtained perfectly fresh and pure, might also equal some of the present substitutes for butter and lard.

The commercial valuation of the fat (from sun-dried kernels) has been given at from £25 to £27 per ton, and that of the kernels probably £10 to £12 per ton. Messrs. Miller Bros.' machine for cracking Palm Nuts (*Elaeis guineensis*) has been tried at the Imperial Institute with "Dika" Nuts, and when used with care appears to be suitable for extracting the kernels (Bull. Imp. Inst. 1906, p. 20). It is not considered advisable to ship the nuts whole. In a supply of unshelled nuts (50 lb.) from S. Nigeria received at the Imperial Institute, only 5 per cent. were fit for use. It is recommended that the oil should be extracted on the spot, or sun-dried kernels shipped (l.c. p. 21). A small trade was done in the seeds by some of the trading houses in the E. Province of S. Nigeria during 1906 (Col. Rep. Misc. No. 51, 1908, p. 41).

The tree could be propagated by seeds, and it appears to thrive in any soil. It is said to be confined to the moist evergreen forests.

Ref.—"On the Nutritive Value of Dika Bread," Attfield, in Pharm. Journ. [2] iii. 1862, p. 445.—"Etudes sur L'Herbier du Gaboon" (*Mangifera gabonensis*), Baillon, in Adansonia viii. pp. 82–88.—"Sur les Vegetaux qui Produiscent le Beurre et le Pam D' O'Dika du Gabon-Congo," Heckel, in Ann. de l'Inst. Col. de Marseille i. 1893, pp .1–31.—*Ibid.* in Ann. Fac. Sc. Marseille, iii. 1893, pp. 1–35.—"Irvingia gabonensis, Dika du Gabon," in Les Bois industriels, indigènes et exotiques, Grisard & Vanden-Berghe, Ed. 2, i. pp. 247-248.—"Dika Nuts from Southern Nigeria," in Bull. Imp. Inst. 1906, pp. 19–22.—*Ibid.* 1908, pp. 374–375.—"Irvingia gabonensis," Drabble, in Quarterly Journ. Inst. Comm. Res. Tropics, Liverpool Univ. Jan. 1908, p. 20.

Irvingia Smithii, *Hook. f.*, Fl. Trop. Afr. I. p. 314.

Nupe.

The fruit is of no value ; it is eaten, according to Barter, by monkeys (Fl. Trop. Afr. i. p. 314). The wood is white, very hard, and is used on the French Congo in construction work (De Wildeman, Pl. Util. Congo, Art. xxvi. p. 379).

BALANITES, Delile.

Balanites aegyptiaca, *Delile* ; Fl. Trop. Afr. I. p. 315.

Ill.—Delile, Egypte, t. 28, f. 1 ; Baillon, Adansonia, ii. t. 10, ff. 9, 10 (flower) ; Schnizlein, Ic. iii. t. 223* ; Haynald, Pl. Gommes, Resines, dans les livres Saints, t. 3 ; Ann. Inst. Col. Marseille, 1902, p. 133, f. 10 ; Thonner, Blütenpfl. Afr. t. 73.

Vernac. names.—Morotodi (Foulah, *Barter* [Nupe]) ; Kuge (Arabic, *Barter* [Nupe]) ; Betu (Beriberi, Bull. Imp. Inst. 1907, p. 332) ; Adua (Hausa, l.c.) ; M'choonchoo (Madi, *Grant*) ; Lol (Senegal, *Sébire*) ; Soump, or Soumpa (Senegal, *Sébire*, *Chevalier*, *Grisard & Vanden-Berghe*) ; Zaccone, Zacon, or Zachun (Arabic, *Grisard & Vanden-Berghe*) ; Heglik or Heglisk (Arabic, *Muriel* [Kordofan], *Colville*) ; Kha (Kordofan, *Muriel*) ; Lalloba (Arabic for fruit, *Muriel* [Kordofan]) ; Lalo (Congo, *De Wildeman*) ; Mutenti (Kibero, Uganda, *Dawe*).—Egyptian Myrobalans ; Desert Date ; Central African Date.

Niger ; Nupe ; Bornu ; Lake Chad Region ; and common in other Northern Provinces of N. Nigeria.

Fruit edible. It has a bitter sweet flavour and aperient qualities ; the natives in the neighbourhood of Fashoda are very fond of it (Colville, Mus. Kew). In Nupe the fruits are eaten and used to make an intoxicating drink (Barter, Herb, Kew). On the Congo the fruits are eaten, and an alcoholic liquor is also made from them. The leaves, according to Barth, are used in Bornu as a vegetable. The root, bark, and leaves are purgative and vermifuge in moderate doses (De Wildeman, Pl. Util. Congo, Art. viii. pp. 50, 53).

The kernels yield an oil known as "Oil of Betu," and as "Zachun Oil," obtained by boiling ; used by the natives to rub on their bodies, and also for food. The natives of Madi eat the fruit and extract oil from the kernel by roasting; they mix the oil with red clay and use the mixture as an unguent for the body (Grant, Trans. Linn. Soc. xxix. p. 43). "Balaninum," one of the ingredients (on the authority of Pliny) in the celebrated Spikenard perfume, is believed to have been furnished by this tree (Sawer, Odorographia, p. 278).

A sample of oil from N. Nigeria examined at the Imperial Institute had the following characters:—Specific gravity 0·919; acid value 5·0; saponification value 196·7; iodine value 92·5; Hehner value 95·2; unsaponifiable matter 0·6 per cent. approx.; percentage of oil in kernels 58·7 (Bull. Imp. Inst. 1908, p. 365). Its colour and taste is said to prevent its use for edible purposes, but as it closely resembles cotton-seed oil it may be utilised in soap-making, for which purpose it has been valued at from £23 10*s.* to £25 per ton. The oil is regarded by the natives of Uganda as a specific for sleeping sickness, but it has been shown by Prof. Cushny that it is of no value in the treatment of this disease (l.c. p. 366).

The wood is described as hard, compact, and fine-grained; used in Abyssinia for making ploughs, clubs, and walking sticks (De Wildeman, Pl. Util. Congo, Art. viii. p. 54); also for carpentry and turnery work (l.c. Art. xxvi. p. 365). Suitable for joists, rafters, framework, cabinet work, pestles and mortars (Grisard & Vanden-Berghe, Les bois industriels, p. 246). The bark of the young trees yields a very strong fibre of white colour (Grant, Trans. Linn. Soc. xxix. p. 43).

The tree in Egypt flourishes in a black soil (Sawer, Odorographia, p. 472); found growing in Kibero, Uganda, at an approximate altitude of 2,300 feet (Dawe, Herb. Kew).

Ref.—"Balanites aegyptiaca," in Flore d'Égypte, Delile, 1812, pp. 77–85.—*Ibid.* in Les Bois Industriels, indigènes et exotiques, Grisard & Vanden-Berghe, i. pp. 246–247 (Soc. Nat. d'Acclimatation, Paris, 1890 ?).—"Lalo ou Balanites aegyptiaca," in Les Pl. Util. du Congo, De Wildeman, Art. viii. pp. 50–54.—"Balanites aegyptiaca Oil," in Bull. Imp. Inst. 1908, pp. 364–366.

OCHNACEAE.

Lophira, Banks.

Lophira alata, *Banks*; Fl. Trop. Afr. I. p. 174.

Ill.—Gaertner, Fruct. Sem. Pl. iii. t. 188; Guillem. Perr. Rich. Fl. Senegamb. t. 24; Chevalier, Geog. Bot. Fl. Econ. Senegal et Soudan, 1900, p. 205; Ann. Inst. Col. Marseille, i. 1903, p. 5, f. 29 (A fruit, B graine, C jeune plantule); Stone, Timb. Comm. t. 1, f. 6 (Photo-micro. trans. section of wood × 3); Drabble, in Journ. Inst. Comm. Res. Tropics, Liverpool Univ. Sept. 1907, p. 125.

Vernac. names.—Eki, or Ekki (Lagos, *Moloney*, *Punch*); Meni (Niger, *Goldie*, *Billington*); Gara (Cross River, *Billington*); Zawa (Sudan, Bull. Imp. Inst. 1908, p. 366); Mana (Malinké, Fr. Guinea, *Pobéguin*; Bambarra, *Chevalier*); Méné (Soussou, Fr. Guinea, *Pobéguin*); Kako (Gold Coast, *De Rothschild*); Laintlaintain (Sierra Leone, *Sébire*); Millai or Mille (Sierra Leone, *Stone*, *Scott-Elliott*); Nungka (Sierra Leone, *Smythe*); Niam (*Drabble*)—African Oak; Scrubby Oak; Dwarf Ironwood.

Lagos; Ifon; Brass; Benin; Cross River; Nupe.

The seeds yield an oil known as "Niam Fat" or "Meni Oil." It is used by the natives of Central and West Africa for cooking purposes and as hair oil (Mus. Kew), also in Senegal (Sébire, Pl. Util. Sénégal, p. 41).

It has been found possible to extract 43 per cent. of oil from the kernels, said to be suitable for soap-making, and for this purpose valued at £24 to £25 per ton. The kernels have been valued at about £10 per ton, c.i.f. at Liverpool (Bull. Imp. Inst. 1908, p. 245; a complete analysis is given p. 244 and p. 367).

The bark is used by the Hausa and Yoruba troops as a remedy for malarial fever (Fletcher, Herb. Kew).

The wood is very hard and heavy (specific gravity 1·0208 = about 65 lbs. per cubic foot); described in the trade as a first-class heavy fancy wood; used for furniture and turnery (Mus. Kew). Admiralty experts have valued it as better than Teak (*Tectona grandis*, at about 8*d.* per foot (Punch, Herb. Kew). The market for this wood being already open it may be shipped without risk. (*See* Report on Lagos Woods, Stone, Imp. Inst. Journ. 1902, p. 96; and Tech. Rep. & Sci. Papers, Imp. Inst. p. 297.)

The tree is reported as being confined to the dry open forests of the hinterland, where it is very plentiful (Col. Rep. No. 51, 1908, S. Nigeria, p. 41); found growing on poor rocky soil between Iwo and Ede (l.c. p. 6); observed in Benin Territories (lat. 6°–50′ N.; long. 5°–50′ E.) on an upland plain, at an altitude of probably 1000 feet, covered with long grass, over which the trees were scattered like an orchard at home (Fletcher, l.c.); very common and characteristic of laterite hills from 500–4000 feet in Sierra Leone (Scott Elliott, Herb. Kew); in forests and common in grass fields, Sierra Leone (Smythe, Herb. Kew); plentiful in the woods of Madi, Central Africa, where it flowers in December (Grant, Trans. Linn. Soc. xxix. p. 33).

Ref.—"Huile de Méné ou Méni du Sénégal et de la Côte occidentale d'Afrique (*Lophira alata*)" in Ann. Inst. Col. Marseille, i. 1903, pp. 1–12.—"Lophira alata, African Oak," in The Timbers of Commerce and their Identification, Stone, pp. 6–7 (Rider & Son, Ltd., London, 1904).—"Analysis of Fat from Lophira alata Seeds," Edie, in Quarterly Journ. Inst. Comm. Res. Tropics, Liverpool Univ. Sept. 1907, p. 124.—"The Fruits of Lophira alata," Dr. Drabble, l.c. p. 125.—"Seeds of Lophira alata from Sierra Leone," in Bull. Imp. Inst. 1908, pp. 243–245.—"Zawa Oil from the Sudan," l.c pp. 366–367.

BURSERACEAE.

COMMIPHORA, Jacq.

Commiphora africanum, *Engl.* in DC. Monogr. Phan. iv. (1883) p. 14 [*Balsamodendron africanum*, Arn.; Fl. Trop. Afr. i. p. 325].

Ill.—Guillem. Perr. Rich. Fl. Senegamb. t. 39 (*Heudelotia africana*); Baillon, Adansonia, viii. t. 2 (*Balsamodendrum africanum*, anatomical, f. 1 transverse section of stem; f. 2 microscopic transverse section, and f. 3 vertical section, considerably enlarged); Holmes, in Pharm. Journ. [4] xxii. p. 257 (Seed).

Vernac. names.—Omel Barka (Kuka, *Vogel*) ; Kadige (Kuka, *Elliott*) ; Oanka (Somali, *Holmes*) ; M'gazoo and Katatee (Ugami, Cent. Africa, *Grant*).—African Bdellium ; African Myrrh ; Le Baumier Bdellium (*Sébire*).

Kuka, Bornu ; Kworra (Niger).

This tree is one of the sources of African myrrh or bdellium, a drug resembling the true myrrh (*Commiphora myrrha*, and other species). It is a gum-resin obtained largely in Senegal and Abyssinia ; from the latter place it is exported *viâ* Berbera to Bombay, and thence to London. From Senegal and French Guinea it is exported chiefly to France. It comes sometimes mixed with Gum Arabic (*Acacia arabica*). According to Parker (Pharm. Journ. [3] x. p. 82) it is one of the spurious gums found in Myrrh as imported, and is met with in large tears like opaque bdellium, but the granulation is less coarse, and the surface is traversed by deep cracks ; it is very hard, the conchoidal fracture appears slightly opaque, of a dull bluish stony hue, with a characteristic resinous margin ; reddish and translucent in thin layers ; almost odourless, and of feebly bitter taste.

Like the Myrrhs in general it yields a volatile oil.

African bdellium is used in Pharmacy for making plasters (Planchon & Collin, Drog. Simpl. ii. p. 552). Both African and Indian bdellium are sometimes in demand among varnish makers (Holmes, in Pharm. Journ. [4] vii. 1898, p. 365).

The wood is burnt by Beriberi women of Bornu, for the purpose of fumigating their clothes (Elliott, Herb. Kew) ; a similar use is also recorded on a specimen of the gum-resin collected by Dr. Vogel, near Kuka (Mus. Kew).

According to Grant (Trans. Linn. Soc. xxix. p. 44) the tree has the appearance of the English Blackthorn (*Prunus spinosa*), but more stunted, and is used in Central Africa for making fences.

Ref.—" Myrrh, Its Composition and Impurities," Parker, in Pharm. Journ. [3] x. 1879, pp. 81–84.—" Myrrh," in Pharmacographia, Flückiger & Hanbury, pp. 140–146 (Macmillan & Co., London, 1879).—" Myrrh and Bdellium " in Kew Bull. 1896, pp. 86–95.—" Bdellium d'Afrique," in Les Drogues Simples d'origine Vegetale, Planchon & Collin, ii. p. 552 (Octave Doin, Paris, 1896).—" Myrrh and Bdellium," Holmes, in Pharm. Journ. [4] vii. 1898, pp. 547–548 ; viii. 1899, pp. 26–28 and pp. 77–80, reprinted in pamphlet form by the Pharmaceutical Society.—" Myrrh and its Official Preparations," Alcock, in Pharm. Journ. [4] xix. 1904, pp. 894–896.—" Trade in Aloes, Civet, Myrrh, and Incense " from Aden, in Journ. Soc. Arts, lii. 1904, pp. 763-764.—" The Identity of the Myrrh Tree," Holmes, in Pharm. Journ. [4] xxii. 1906, pp. 254–257, illustrated.

PACHYLOBUS, G. Don.

Pachylobus edulis, *Don* ; Fl. Trop. Afr. I. p. 327 [*Canarium edule*, Hook. f., in Oliver Fl. Trop. Afr. i. p. 327].

Ill.—Engl. Bot. Jahrb. xv. 1893, p. 100, t. 3 (*Canarium Saphu*, fruit) ; Engl. & Prantl, Pflan. iii. pt. 4, p. 242 (*Pachylobus Saphu*, fruit, as in preceding) ; Hook. Ic. Pl. tt. 2566, 2567 ; Thonner, Blütenpfl. Afr. t. 76.

Vernac. names.—Eben or Eban (Old Calabar, *Thomson*, *Holland*; Uwet, *McLeod*; Creektown, *Goldie*); Onumu (Benin, Col. Rep. Misc. No. 51, 1908, p. 88); Safu (St. Thomas, *Don*); N'Safu (Congo, *Bentley*).

Old Calabar; Uwet; Okuni, Ikum, Cross River.

Fruit edible; the natives eat the outer portion boiled or roasted.

The wood is described as white and hard; used for framework and joinery (De Wildeman, Pl. Util. Congo, Art. xxvi. p. 339).

The tree may be propagated from seeds. It is commonly cultivated at Old Calabar, along the roadsides near Uwet (McLeod, Herb. Kew), in the Cameroons (Mann, Herb. Kew), and from St. Thomas to the Congo (Hook. Ic. Pl. tt. 2566, 2567).

Ref.—Hook. Ic. Pl. 1899, tt. 2566, 2567.—"The Eben Tree of Old Calabar," in Kew Bull. 1906, pp. 172–173.

CANARIUM, Linn.

Canarium Schweinfurthii, *Engl.* in DC. Monogr. Phan. iv. p. 145.

A large tree, leaves over 2 ft. long, imparipinnate; leaflets 11–13 pairs, 1¼–1½ inches apart, shortly stalked, oblong, slightly cordate at the base, acuminate, the upper ones 6–7 inches long, 1½–2½ inches broad, the lower hardly more than half as long; lateral nerves 17–23 on each side of the midrib; veins densely reticulate, prominent below. Panicles up to 1 ft. long; lateral branchlets few-flowered, up to 1½ inches long. Flowers over ⅓ inch long; pedicel and calyx greyish or yellowish pubescent. Drupes obovoid.

Vernac. names.—Onanakuku (W. Prov. S. Nigeria, *Thompson*); Mubafo (Angola, *Welwitsch*); Mpafu (Tanganyika, *Kirk*, *Thomson*); Mwafu (Uganda, *Mahon*, *Dawe*); Mombele (Congo, *De Wildeman*).—African Elemi.

Modakeke, S. Nigeria (Foster, Herb. Kew); W. Prov. S. Nigeria (Thompson, Herb. Kew).

The so-called African Elemi has been attributed to the preceding species. *See* Planchon & Collin, in "Les Drogues Simples," ii. p. 558, *Canarium edule*, Hook. f.; Moloney, "Forestry of West Africa," p. 295, *Canarium edule*, Hook. f., "Mpafu" or "Mubafo"; Hiern., "Catalogue of Welwitsch's African Plants," i. 127 (stated here to also yield an oil), *Canarium edule*, Hook. f., more especially with reference to the specimens named "Mutafo" or "Nbafo"; but these statements, together with the note under "'Mpafu' tree of Tropical Africa," *Canarium* sp., in Kew Report, 1880, p. 50, probably apply to *Canarium Schweinfurthii*, Engl., the "Mpafu" of Uganda, "Mbafu" of Tanganyika, "Mupafu" of Mukenge, and "Mubafu" of Angola, as in Engler, "Pflanzenwelt Ost-Afrikas," B. p. 199, where the matter relating to the Elemi and oil seems to be, perhaps for the first time, accurately put. There are several specimens of *Canarium Schweinfurthii* in the Museum which bear out this view (Kew Bull. 1906, p. 172).

"*Canarium Schweinfurthii*, Engl., a genuine Canarium having a thick, exceedingly dense and hard endocarp, has been confused with *Pachylobus edulis*, G. Don. Both trees yield an edible fruit and bear similar or perhaps in some districts the same name, and the leaves are sufficiently alike to deceive a superficial observer. The first-named is evidently very wide-spread, ranging from near the West Coast, eastward to the lakes and northward to Uganda (Hook. Ic. Pl. tt. 2566, 2567).

It seems probable that African Elemi is also obtained from other species; there are five other species of *Canarium* known from Tropical Africa at the present time: *C. Buettneri*, Engl., and *C. velutinum*, Guillaumin, from the Gaboon; *C. Liebertianum*, Engl., from E. Africa; *C. macrophyllum*, Oliv. from Small Kobi Island, Gulf of Guinea, and *C. Thollonicum*, Guillaumin, from Oubanghi (Modzaka); two of which are described as giving a resin. —*C. Buettneri* and *C. velutinum*, the former, with an odour of turpentine and camphor, and the latter a whitish resin (*see* Guillaumin, Bull. Soc. Bot. France, viii. 1908, pp. 264 and 267). The main source of Elemi is *Canarium luzonicum*, A. Gray, " Manila Elemi " or " Brea," from the Philippine Islands.

Elemi is used in medicine, in the preparation of ointment and plasters, and in the manufacture of printing inks and varnishes. In the Philippines it is used for caulking boats and for making torches (Mus. Kew). In West Africa it is said to be used for roofing (Monteiro, Mus. Kew); in Uganda it is used in the Roman Catholic Churches as incense (Dawe, Rep. Bot. Mission, Uganda Protectorate, 1906, p. 40), occasionally burnt for the sake of its pleasant odour and as an illuminant (Mahon, Mus. Kew); the Waganda (Victoria Nyanza) use it, ground down with fat, for rubbing over the body (Engl. Pflan. Ost. Afr. B. p. 412), and the natives of Cazengo employ the resin in the form of a plaster to cure wounds (Hiern, Cat. Welw. Afr. Pl. i. p. 127). The powdered bark is used by the natives of Angola in the treatment of syphilitic and scorbutic ulcers (l.c.). The Elemi is obtained by making incisions in the trunk, and according to Mahon (Mus. Kew) it exudes as a thin very oily fluid, almost transparent, but with a grey tinge and having a rather acrid odour. Manila Elemi realises on an average about £3 per cwt., but the demand is limited.

Samples of Elemi from S. Nigeria and Uganda have been examined at the Imperial Institute, and the data obtained go to show that they resemble in properties the Manila Elemi, but give a smaller yield of volatile oil. It has been suggested that the African Elemi, if carefully collected and stored so that it could be put on the market in a soft, clean condition, comparable with that of Manila Elemi, would be equally serviceable as an ingredient in the manufacture of printing inks and varnishes (Bull. Imp. Inst. 1908, p. 255).

A fragrant pleasant smelling oil is obtained from the outer portion of the fruit. According to Cameron (*see* Engler, Pflan. Ost. Afr. B. p. 474) it is extracted by soaking the fruits in water in large receptacles for some days, the oil as it collects on the surface being skimmed off. The fruit soaked in water is used as a condiment with various foods (l.c. p. 199); a similar use is attributed to the fruits in Angola (Hiern. Cat. Welw. Afr. Pl. i. p. 127).

The wood is said to be proof against borers, &c. ; it is described as light, hard, of a pale yellow colour, and excellent for the construction of canoes (De Wildeman, Pl. Util. Congo, Art. xxvi. p. 367).

Ref.—"Canarium Schweinfurthii," in Pflan. Ost Afrikas, Dr. Engler, B. pp. 199-200 (Dietrich Reimer, Berlin, 1895).—"Elemi Resin from Liberia," in Bull. Imp. Inst. 1907, pp. 186–187, —"African Elemi," including "Elemi from S. Nigeria," and "Uganda Elemi from *Canarium Schweinfurthii*," in Bull. Imp. Inst. 1908, pp. 252–255.

Santiriopsis, Engl.

Santiriopsis Klaineana, *Pierre*, in Bull. Soc. Linn. Paris, ii. p. 1282.

A small tree. Branches over 1 in. in diameter, young parts scaly, puberulous. Leaves alternate, imparipinnate ; common petiole 2 in. long ; leaflets 1–3 pairs ; partial petioles ¼–⅗ in. long ; blade 2–5 in. long, 1–2¼ in. broad, oblong-lanceolate, acute at the base, rather obtuse at the apex, coriaceous, glabrous, in a dried state brown above, shining and somewhat reddish below ; lateral nerves 11, prominent on both surfaces, midrib sinuate, veins closely reticulate. Racemes 7 in. long, axillary, puberulous ; branches very short or reduced to almost sessile clusters of flowers. Flowers trimerous. Sepals elliptic, 1 lin. long. Petals scaly on both surfaces. Filaments glabrous, inserted at the base of the disc. Anthers elliptic, glandular on the back. Ovary 2-celled, pubescent ; ovules 2 in each cell. Drupe straight ; exocarp fleshy, endocarp crustaceous. Seed solitary ; cotyledons deeply lobed.

Vernac. name.—Odonomokyuku (Benin, *Thompson*).

Benin.

The wood of this species resembles Panama Mahogany in structure ; saws about as hard as oak, giving off a pungent smell ; planes badly, being cross-grained and woolly ; polishes fairly well, and takes nails well. It is considered a wood of poor quality, not ornamental, and of no use for export (Bull. Imp. Inst. 1908, p. 148). The weight per cubic foot is 43·8 lbs. (l.c. p. 147, q.v. for other physical properties).

MELIACEAE.

Melia, Linn.

Melia Azedarach, *Linn.* ; Fl. Trop. Afr. I. p. 332.

Ill.—Commelin, Hort. Med. Amstel. Pl. t. 76 (*Azadirachta indica*) ; Cav. Diss. t. 207 ; Bot. Mag. t. 1066 ; Chaumeton, Fl. Med. i. t. 50 ; Lam. Encycl. t. 357, f. 2 ; Duhamel, Traite des Arbres, vi. t. 21 ; Desc. Ant. i. t. 46 ; Bot. Reg. t. 643 (*M. sempervirens*) ; Mem. Mus. Paris, xix. t. 13, f. 4 ; Wight, Ic. Pl. Ind. or. i. t. 160 ; Schnizlein, Ic. t. 225 (*M. sempervirens*) ; Rev. Hort. 1872, p. 470 (*M. floribunda*) ; Baillon, Hist. Pl. v. p, 470, f. 462, p. 471, ff. 463, 464) ; Bedd. Fl. Sylv. t. 13 ; De Candolle, Monogr.

Phanerog. i. t. 6, f. 9 ; Mart. Fl. Bras. xi. pt. 1, t. 50 ; Belgique Hortic. 1880, t. 9 (var *floribunda*) ; Vidal, Fl. For. Filip. t. 29E ; Engl. & Prantl, Pflan. iii. pt. 4, f. 160A–L.

Vernac. names.—Eke-Oyibo (Oloke-Meji, *Dodd*) ; Eke-Oyinbo (Lagos, *Dawodu*) ; Kurna-na-sara (Kontagora, *Dalziel*).—Persian Lilac ; Bead Tree ; West Indian Bead Tree ; Pride of India ; China Berry ; Bastard Cedar ; Tree of Paradise.

Oloke Meji ; Kontagora ; Yoruba. Widely distributed in Tropical Africa and commonly cultivated in many other tropical and sub-tropical countries.

All parts of the plant appear to be used for various medicinal purposes (India, America, &c.). The leaves and flowers applied as a poultice are used in India to relieve nervous headaches ; and the juice of the leaves as an anthelmintic, antilithic, diuretic, and emmenagogue (Dict. Econ. Prod. Ind.). The root bark, which is very bitter, is used in America as a cathartic and emetic (Goodale, Mus. Kew), and the stem bark possesses anthelmintic, stimulant, antispasmodic and tonic properties (Mus. Kew). The fruit is poisonous and the bark and leaves are also said to possess toxic properties. Loudon states that the fruit is poisonous in a high degree, and mixed with grease will kill dogs (Encycl. Pl. p. 352). The stones are sometimes used for making rosaries and necklaces. Royle states that the seeds are emetic, laxative and anthelmintic (Ill. Bot. Himal. p. 144). The kernels yield an oil described as similar to that of the Neem or Margosa (*Melia Azadirachta*)—fixed, acrid, bitter, deep yellow, and of a strong disagreeable flavour, used in India as an anthelmintic and antiseptic, also for burning in lamps, but said to smoke offensively (Dict. Econ. Prod. Ind.). The tree yields a brown adhesive gum, but this, as also the oil, is not considered important (Watt, Comm. Prod. India, p. 781). The oil has been examined by Fendler, who gives the specific weight as 0·9253 at 15° C. ; Fusion point—3° C. ; Solidification point 12° C. ; Fusion point of the acid fat 22° C. ; Solidification point of acid fat 19° C. (De Wildeman, Pl. Util. Congo, Art. xxx. p. 487).

The wood is recorded by Hough as weighing 38 lbs. to 40 lbs. per cubic foot (American Woods, v. No. 105), by Gamble 35–38–40 lbs. per cubic foot (Man. Ind. Timb., p. 145) ; a good cabinet wood not unlike teak (Dalziel, Bull. Imp. Inst. 1907, p. 261). It is used for furniture, and takes a good polish (Mus. Kew) ; apparently little used in America, although described as very appropriate for nice furniture, and similar in properties to mahogany (Hough, l.c.) ; used with success at the Imperial Forest School, Dehra Dun, India, for museum cases and other furniture (Gamble, l.c.). In Oloke-Meji the wood is used for roofing houses (Dodd, Herb. Kew).

Under cultivation the seeds germinate freely, and the plants grow rapidly. The very ornamental appearance of the tree for avenues, &c., is regarded by many as the foundation of its real value. In India, where it is commonly cultivated, it is met with up to an altitude of 6,000 feet (Watt, Comm. Prod. India, p. 781). In Kontagora it is common in native compounds ; flowers in

October; subject, during growth, to injury by white ants, and its leaves to attacks by insects of the genus *Batocera* (Dalziel, l.c.).

Ref.—"Melia Azedarach," in Dict. Econ. Prod. India, Watt, v. pt. 1, 1891, pp. 221–223.—"Melia Azedarach," in The American Woods, Hough, v. No. 105, pp. 28–29, with sections—transverse, radial, and tangential—of the wood (published by the Author, Lowville, New York, 1894).—"Melia Azedarach," in Manual of Indian Timbers, Gamble, pp. 144–145 (Sampson, Low, Marston & Co., Ltd., London, 1902).—"Melia Azedarach on Lilas des Falls," in Pl. Util. Congo, Art. vii. pp. 42–49.—"A Propos du Melia Azedarach," l.c. Art. xxx. pp. 486–488.—"Melia Azedarach," in Der Tropenpflanzer, 1904, pp. 578–580.

Guarea Thompsonii, *Sprague & Hutchinson*, in Kew Bull. 1906, p. 245.

A tree. Branchlets glabrous below, minutely puberulous above, ⅓ in. in diameter or more. Leaves pinnate, 1½ ft. long or more, glabrous; leaflets shortly stalked, oblong or obovate oblong, more rarely oblanceolate, 4–8 in. long, 2–3 in. broad, obtuse or very shortly acuminate at the apex, rounded or obtusely cuneate at the base, chartaceous; veins and veinlets inconspicuous on the upper surface, slightly raised on the lower; lateral nerves 11–14 on each side of the midrib. Panicles axillary, borne several together towards the ends of the branchlets, pyramidal, 6 in. to 1 ft. long; rhachis puberulous. Flowers over ⅓ in. long. Calyx cupular, hardly toothed. Petals 5 or 6, imbricate, oblong. Staminal tube slightly swollen about the middle, terminated by 10–15 small lobes; anthers 10–15, inserted inside the tube a little below its apex. Ovary oblong, hairy, 4–5-celled, ovules 2 in each cell; style glabrous; stigma peltate.

Benin.

Cedar; Benin Mahogany.

Wood exported to Europe under the trade names given above.

The species of *Guarea* are found in the moist evergreen forests (Thompson, Col. Rep. Misc. No. 51, 1908, p. 24).

TRICHILIA, P. Brown.

Trichilia emetica, *Vahl.*; Fl. Trop. Afr. I. p. 335.

Ill.—Bertoloni, Misc. Bot. ix. t. 2 (*Mafureira oleifera*); Trans. Linn. Soc. xxix. t. 20; Wood, Nat. Pl. i. t. 80; Sim, For. Fl. Cape Col. t. 27; Sim, For. Fl. Port. E. Afr. t. 15.

Vernac. names.—Mafoureira; Bafureira (Portuguese Mozambique, *Ficalho*); Tsikiri (Mozambique, *Johnson*); Elcaja (Arabia, *Ficalho*); Guimbi (Engoche, Tala Mugongo, *Ficalho*); Mahura (Kalahari, S.E. Africa, *Burchell*); Mafura (Inhambane, *Kirk*); Páo Cachique (Golungo Alto, *Welwitsch*); Motsakiri (S.W. Trop. Africa, *Baines*); Esschenhout (Dutch, in Pondoland and Natal, *Sim*); Um-Kuhlu (Kafir, *Sim, Wood*).—Cape Mahogany; Manubi Mahogany; Natal Mahogany.

Kontagora, Borgu, N. Nigeria, and widely distributed in Tropical Africa, from Senegambia through Abyssinia to Mozambique.

The seeds contain about 60 per cent. of a fatty oil used by the natives in cookery and suitable for the manufacture of soaps and candles. The fat, owing to its acidity, is not considered suitable for edible, pharmaceutical, or lubricating purposes without special treatment. From samples examined at the Imperial Institute it has been found that the kernels amount to 88 per cent. and the shells to 12 per cent. of the whole seed, the former yielding 68 per cent. of oil and the latter 14 per cent.

The oily constituents of the nut are solid at the ordinary temperature, and in this respect resemble fats of the same class as palm oil, cocoanut oil, etc. They are chiefly composed of palmitin and olein, together with some free fatty acid, chiefly oleic.

A chemical examination furnished the following results :—

—	Melting Point.	Solidifying Point.	Acid Value.	Saponification Value.	Iodine Value
Fat from the entire kernels.	37° C.	20–25° C.	52·5	240	55·8
Fat from kernels only	40° C.	25–30° C.	42·4	241	47·8

The commercial value of the Mafoureira nut has been estimated at from £8 to £9 per ton delivered in Hull, in consignments of not less than from 50 to 100 tons, but it is recommended that the oil should be expressed in the countries of production in preference to shipping the raw material (Bull. Imp. Inst. 1903, p. 28).

At Inhambane the seed can be bought for little more than ½*d.* per kilo. (about 42*s.* per ton), and it sells in Marseilles for £8 per ton, freight costing (1901) 50*s.* per ton (Cons. Rep. Ann. No. 2630, 1901, p. 4). A sample of seeds sent to Kew (October, 1906) by Mr. W. H. Johnson from Mozambique was valued in London at £9 10*s.* per ton (Mus. Kew). The cake is said to contain nearly the same percentage of nitrogen compounds as linseed cake (*Linum usitatissimum*) (Bull. Imp. Inst. l.c. p. 29).

In 1900, 270 tons of seed were shipped from Inhambane to Marseilles and 2 tons to Hamburg (Cons. Rep. Ann. No. 2630, 1901, p. 4).

The wood does not readily warp or shrink, and sound planks 3–4 feet wide may be cut, though it is apt to become worm eaten within a year or two ; it is used in Cape Colony for yokes and general purposes ; polishes well and makes very pretty furniture, and several shades of colour can be obtained from the same species (Sim, For. Fl. Cape Col. p. 161). In South Tropical Africa it is used for making small canoes, etc. (Baines, Mus. Kew). In Zanzibar it is used for making platters and small canoes (Kirk, Mus. Kew).

According to Grant, the bark in the neighbourhood of Madi, Central Africa, is used as a cure for syphilis, and the natives obtain from the tree a liquid which they use as a sauce (Trans. Linn. Soc. xxix. p. 45) ; the bark is said to be poisonous ; used by the natives of Cape Colony as an emetic in small doses (Sim, l.c.).

The tree may be readily propagated by seeds, but like other oily seeds they are not likely to retain their vitality for any length of time. In Mozambique it grows wild all over the country (Cons. Rep. Ann. No. 2630, 1901, p. 4). In Unyoro, Uganda, it has been found growing on open land (Dawe, Herb. Kew). In Cape Colony it grows on rich alluvial soil about 15 miles from the sea, but not on the sea dunes, and is less abundant on shallow shale soils (Sim, l.c. p. 160). Wood describes it as one of the handsomest trees indigenous to Natal, where it grows in the Coast districts (Nat. Pl. i. p. 66).

Ref.—"Trichilia emetica," in Trans. Linn. Soc. xxix. 1875, p. 44.—"Trichilia emetica," "Mafoureira," "Maforia," "Motsakiri," "Mafurra," "Mafutratalg," in Pflanzenwelt, Deutsch Ost. Afrika, Dr. Engler, B. pp. 475–476 (Dietrich Reimer, Berlin, 1895).—"Mafoureira Nuts from Portuguese East Africa," in Bull. Imp. Inst. 1903, pp. 26–29.—Forest Flora, Cape Colony, Sim, pp. 160–161 (Taylor & Henderson, Aberdeen, 1907).

Trichilia Heudelotii, *Planch.* ; Fl. Trop. Afr. 1. p. 334.

Vernac names.—Ovala (Benin, *Thompson*) ; Jauwi (Sierra Leone, *Scott Elliott*).

The bark furnishes a red dye used for cloth by the natives at Kafogo, Sierra Leone (Scott Elliott, Col. Rep. Misc. No. 3, 1893, p. 31).

Trichilia Prieuriana, *Juss.* ; Fl. Trop. Afr. I. p. 334.

Ill.—Guillem. Perr. Rich. Fl. Senegamb. t. 30.

Vernac. names.—Awe (Lagos, *Punch*).—Monkey Apple (Sierra Leone, *Scott Elliott*).

Lagos ; Old Calabar.

A handsome decorative tree. Wood very hard and red (Punch, Herb. Kew).

CARAPA, Aubl.

Carapa guianeensis, *Aubl.* ; Fl. Trop. Afr. I. p. 336.

Ill.—Aublet, Guiana, t. 387 ; Lam. Encycl. t. 301, f. 2 ; Desc. Ant. vi. t. 446 ; Mem. Mus. Paris, xix. t. 20 ; De Candolle, Monogr. Phanerog. i. t. 9, f. 2 ; Mart. Fl. Bras. xi. pt. 1, t. 64 ; Engl. & Prantl, Pflan. iii. pt. 4, f. 156 F–H ; Stone, Timb. Comm. t. 3, f. 24 (Photo-Micro. trans. sec. of wood × 3) ; Journ. Inst. Comm. Res. Tropics, Liverpool Univ. Jan. 1908, p. 24, f. 6 (Seed).

Vernac. names.—Koudou (Ivory Coast, *Pobèguin*) ; Kobi (Bambara, *Pobèguin*) ; Gobi (Soussou, *Pobèguin*).—Crabwood ; Crab Tree.

Eppah, Niger ; common in British Guiana and other parts of Trop. America.

The seeds yield an oil known in commerce as "Carap" or "Crab oil." It is reputed to possess anthelmintic properties and to be a powerful insecticide. Insects are said not to go near trees daubed with the oil. Soap made from the oil dissolved in water is an efficient insecticide for greenhouse or outdoor plants. The oil has also been recommended for soap and candle-making if it can be produced at a reasonable cost (Gane, Pharm. Journ. [3] xxv. p. 1150).

Administered internally the oil is said to possess slight purgative properties, but the taste is too nauseous to admit of its employment for this purpose (l.c.). The very bitter taste would also prevent its use as a food. In British Guiana it is used for dressing the hair, as an anthelmintic, for healing wounds, and for burning in lamps (Mus. Kew).

The constituents of the oil have been defined as : free fatty acid, glycerates of oleic, palmitic and stearic acids, and a small amount of a bitter principle of an alkaloidal character ; the melting point at about 20° C., and the specific gravity at 15° C. as 0·923 (Gane, l.c.).

The bark of the tree is also very bitter, and is considered a good febrifuge.

The wood, according to Laslett, is used as a substitute for plain and inferior mahogany (Timber and Timber Trees, p. 410), but is unsuitable for important works of construction on account of a strong tendency to split and tear during seasoning (l.c. p. 277). Stone found a log about 18 inches in diameter to work up very well (Timb. Comm. p. 39). Used in British Guiana for mill and mortar-beds, ordnance, house framing, etc. (l.c.) ; for furniture, shingles, and the masts and spars of vessels (Mus. Kew). A specimen at Kew is light brown in colour ; it is stated to take a fine polish and to make most durable furniture ; specific gravity ·667 (=41·6 lbs. per cubic foot). In 1886 it was selling at 9*d.* to 1*s.* 3*d.* per cubic foot, f.o.b. Demerara River ; shipped in logs 10 to 20 inches square (Cat. Woods, Brit. Guiana, suitable for cabinet making. Exhibit by Park and Cunningham, Demerara, at the Col. and Indian Exhib. 1886, S. Kensington, p. 11, No. 42). This specimen now shows a specific gravity of ·5858=36·6 lbs. per cubic foot (Mus. Kew).

Ref.—" Fixed Oil of Carapa guianensis," Gane, in Pharm. Journ. [3] xxv. 1895, p. 1150.—" Huile de Carapa de la Guyane," Heckel in Ann. Inst. Col. Marseille, v. 1898, 2nd fasc. (Graines Grasses nouv. Col. Franç.) pp. 141–152.—" Carapa Oil from Trinidad," in Tech. Rep. & Sci. Papers, Imp. Inst. 1903, pp. 135–136.—" Andiroba Nuts from Sergipe, Brazil, received through the Foreign Office," l.c. pp. 136–137.—Mechanical Properties of the Wood, l.c. p. 285.—" Crabwood " in Timbers of Commerce, Stone, pp. 38, 39 (W. Rider & Son, Ltd., London, 1904).

Carapa procera, *DC.* Prod. i. (1878), p. 626.

A tree, 70–80 ft. high or less. Leaves paripinnate, 1½–2 ft. long ; leaflets 6–12 pairs, shortly stalked obovate-oblong or elliptic-oblong, shortly acuminate to the apex, cuneate at the base, 8–12 in. long, 2–3 in. broad, coriaceous, glabrous, shining on the upper surface, dull on the lower. Panicles lax, many-flowered, equalling the leaves. Flowers pinkish, pentamerous, $\frac{1}{6}$ in. long, glabrous. Sepals rounded. Petals obovate. Staminal tube ovoid, obtusely 10-toothed ; anthers 10, just within the tube, alternating with the teeth. Disc fleshy. Ovary 5-celled, equalling the style; stigma discoid. Capsule subglobose, 5-celled, 5-valved; valves crested-tuberculate. Seeds trigonous, about 6 in each cell.

Ill.—Engl. & Prantl, iii. pt. 4, f. 156 A–E; Journ. Inst. Comm. Res. Tropics, Liverpool Univ. Jan. 1908, p. 24.

Vernac. name.—Ibegogo (Cent. Prov. S. Nigeria, *Unwin*).

The seeds of this species are believed to yield the "Touloucouna" oil of West Africa, although, in view of the general similarity of the oil of several of the known species of *Carapa*, it is possible that the name may be largely a geographical one. The uses in Africa appear to be identical with those of the preceding species. The seeds, under the name of "Krufie," have recently been received at Kew from West Africa, where the oil, which is extracted by grinding and boiling, is used for the cure of yaws, burns, and mosquito bites (Mus. Kew). In Marseilles the oil is used for soap-making (Planchon & Collin, Drog. Simpl. ii. p. 670).

Heckel gives an analysis of "Touloucouna" oil, in comparison with that of "Carapa" oil, and is of the opinion that they are distinct products. (*See* Les Graines Grasses Nouvelles ou peu connues des Colonies Françaises, Paris, 1902, pp. 141–153.)

Lewkowitsch, however, is of the opinion that there is not sufficient justification for considering "Carapa" oil and "Touloucouna" oil as two different individuals in view of the uncertainty attaching to the origin and to the original condition of the fats. (*See* Carapa oil in the Analyst, May, 1908.)

The bark possesses tonic and febrifugal properties.

There is no specimen of the wood at Kew, but it is possible that it is somewhat similar to that of *C. guianensis*—the only other known species of *Carapa* (*C. grandiflora*) from Tropical Africa has much the same appearance and general characters. It is strong, durable, and capable of taking a good polish. The specific gravity by experiment is ·6061, and the weight per cubic foot by calculation is 37·8 lbs. (Mus. Kew). Wood believed to belong to *C. procera* has been valued on the English market at 2½*d.* to 3½*d.* per foot, as a timber with some of the qualities of both cedar and mahogany.

Seeds are said to be produced very freely, and the tree is very common in the Central Province (Kew Bull. 1908, p. 194).

Ref.—"Kundoo" oil, in Technologist, 1862, pp. 343–345.—"Beurre de Touloucouna," Heckel in Ann. Inst. Col. Marseille, v. 1898, 2nd fasc. (Graines Grasses nouv. Col. Franç.) pp. 153–160.—"Un Fébrifuge du Congo" in Pl. Utiles du Congo, De Wildeman, No. 1, 1903, pp. 55–62 (Spineux & Co., Brussels).—"Carapa procera, an oil-yielding tree of West Africa," Dr. Drabble in Journ. Inst. Comm. Research in the Tropics, Liverpool Univ. iii. 1908, pp. 21–24.—"Carapa oil," Dr. Lewkowitsch, pp. 1–4; Reprint from the Analyst, May, 1908, giving an analysis of "Carapa oil," "Touloucouna oil," and oil from the seeds of Carapa grandiflora, *Sprague*, including a commercial valuation of the kernels and oil.

ENTANDROPHRAGMA, C. DC.

Entandrophragma Candollei, *Harms,* in Notizbl. Bot. Gart. Berlin, i. 1896, p. 181.

A tree, 100 ft. high or more. Bark smooth, ashy grey. Leaves alternate, abruptly pinnate, over 1 ft. long; leaflets 6–7 pairs, sessile, oblong or obovate-oblong, shortly and abruptly acuminate at the apex, unequally cuneate at the base, 3–4½ in. long, about 1½ in. broad, slightly puberulous on the nerves of the lower surface, otherwise glabrous; lateral nerves 12–18 on each side of the midrib, prominent below; petiole and rhachis sparingly rusty-pubescent. Panicles about 1 ft. long, many-flowered, pubescent. Flowers about ¼ in. long. Calyx cupular, 4–6-toothed. Petals 4–6, usually 5, oblong. Staminal tube glabrous or nearly so, divided above into 10 anther-bearing segments, joined in its lower part to the gynophore by means of membranous ribs. Ovary seated on a short gynophore, ovoid, 5-celled; ovules 8–10 in each cell.

Vernac. name.—Ikwapobo (Benin, *Thompson*); Atore (Calabar, *Sheriff*).—Unscented Mahogany; Long-capsuled Mahogany.

Benin; Old Calabar.

The wood is valued at about 3*d.* to 4*d.* per superficial foot. The tree is said to furnish a high percentage of figured logs, and to get this timber in good condition the Forestry Department advise girdling the trees, thus allowing them to die off gradually and season effectually, otherwise the wood is disliked by the trade, being rather gummy and unsuitable for veneers. (*See* Col. Rep. Misc. No. 51, 1908, p. 24, and Kew Bull. 1908, p. 189.)

According to tests made by Unwin and Dalby on specimens obtained from S. Nigeria, the timber has the following characters: Weight per cubic foot, 42·1 lbs.; coefficient of transverse strength in lbs. per sq. inch, 6,319; stress at elastic limit in lbs. per sq. inch, 3,315; coefficiency of elasticity in lbs. per sq. inch, 985,500; load at centre in lbs., 7,000; deflection in inches, ·438; shearing stress in lbs. per sq. inch, 895; crushing stress in tons per sq. inch, 1·92 (Bull. Imp. Inst. 1908, p. 147).

The working properties of the timber, according to Stone, are that it is both ornamental and useful, and valuable for export; that it resembles African Mahogany in all respects and would pass as such; it saws as hard as elm, with an unpleasant spicy smell; planes fairly well, but inclined to be cross-grained; takes nails badly; fissile and cleaves with a smooth shining surface, and takes an excellent finish when polished. It is weak and brittle, and the fracture is biscuit-like and splintery (l.c. p. 152).

The trees are found in the evergreen forests of the plains, and on account of their size they have not usually been destroyed by the natives when cutting new forest for farming purposes; it is to this exposure to light, leading to the development of adventitious buds, that the fine figure of many of the logs is probably due (Thompson, Col. Rep. l.c. p. 58). It is plentiful in the drainage areas of the Jamieson and Ethiope Rivers, and is always found on high land

(Kew Bull. l.c. p. 190); found in the forests of Jebu-Ode, Ife, and Ilesha (Thompson, Col. Rep. l.c. p. 6), in the forest reserve of the Oban Hills, and in the Cross River region (l.c. pp. 7, 8).

KHAYA, A. Juss.

Khaya grandis, *Stapf.*

A glabrous tree. Leaves pinnate, with 4 pairs of leaflets; leaflets oblong or subovate-oblong, often oblique, shortly and frequently obscurely apiculate, rounded to shortly cuneate at the base; 7–9 in. long, 4–5 in. wide, papery, margin more or less undulate; common rhachis (inclusive of petiole), about 9 in. long; petiolules 6 lin. long. Panicles 3–6 in. long, 3–4 in. wide, very loose, pedicels very short or up to 1½ lin. long. Flowers pentamerous (only known in the hermaphradite condition). Calyx flat, 1 lin. in diameter; sepals rotundate. Petals 2 lin. long. Staminal tube globose-urceolate, hardly constricted below the mouth, about 1¾ lin. long. Anthers ½ lin. long. Ovary adnate to a crenulate disc; stigma sessile, disciform, crenulate; ovules about 15 in two rows.

Vernac. name.—Ogwangu (Benin, *Thompson*).—Benin Mahogany.

Jebu-Ode, Ife, Ilesha, Mamu, Western Province, S. Nigeria.

The timber is a regular article of export.

Found in the forests of the localities mentioned though not very plentiful in Mamu (Thompson, Col. Rep. Misc. No. 51, 1898, pp. 4, 6).

See under *Khaya senegalensis.*

Khaya Punchii, *Stapf.*

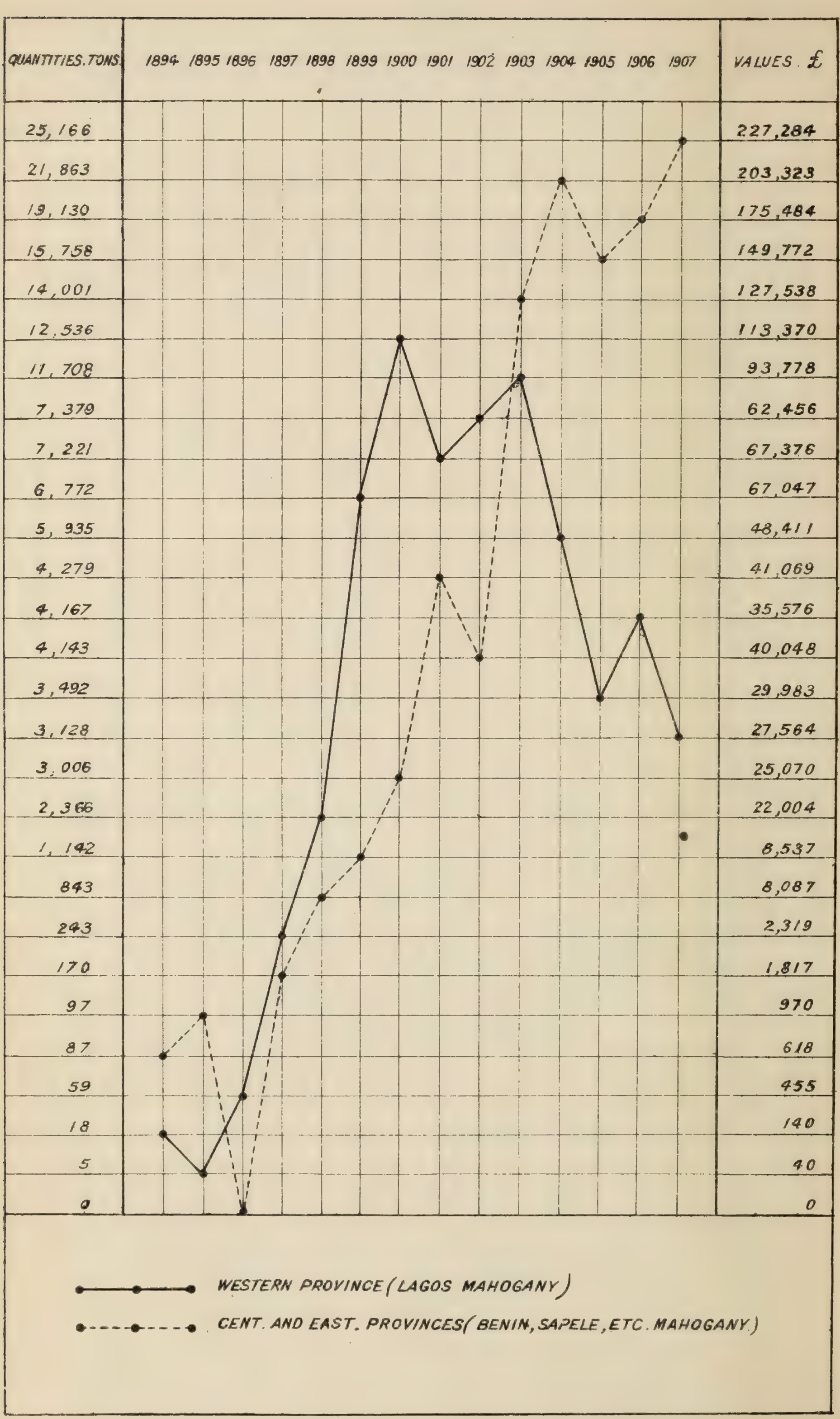
A glabrous tree. Leaves pinnate with 3 or less, often 4, pairs of leaflets; leaflets ovate-oblong to oblong, shortly and often abruptly acuminate, rounded or very shortly and broadly cuneate at the base; 4–7 in. long, 2–4 in. wide, papery, margin more or less undulate; common rhachis (inclusive of petiole) 6–12 in. long; petiolules 3–6 lin. long. Panicles 6–9 in. long, 3–4 in. wide, rather loose; pedicels very short. Flowers pentamerous (only known in the androdynamous state; that is they are apparently hermaphrodite but are actually male). Calyx flat, 1 lin. or less in diameter; sepals rotundate. Petals 2–2½ lin. long. Staminal tube, globose-urceolate, hardly constricted below the mouth, about 2½ lin. long. Anthers ½ lin. long. Ovary surrounded at the base by an adnate disc; style cylindric, as long as the ovary; stigma disciform; ovules very minute, barren.

Vernac. name.—Ogwangu (Benin, *Thompson*, *Unwin*).; Eggo (Ibo, *Thompson*); Oganwo (Lagos, *Punch*).—Benin Mahogany.

Ibadan Forest Reserve, Lagos; Benin.

The timber realises good prices and is much in demand. The tree is said to be found in areas that are under water for several months in the year (Thompson, Col. Rep. Misc. No. 51, 1908, p. 24, and Kew. Bull. 1908, p. 189); found in the swamp forests between the Forcados, Ramos, and Dodo Rivers (Col. Rep. l.c. p. 7).

See also under *Khaya senegalensis.*



EXPORTATION OF MAHOGANY.

2921. Wt 13794. 22/2. 1000. 7/09.

Khaya senegalensis, *A. Juss.*; Fl. Trop. Afr. I. p. 338.

Ill.—Mem. Mus. Paris, xix. 1830, t. 21; Guillem. Perr. Rich. Fl. Senegamb. t. 32; De Candolle, Monogr. Phanerog. i. 1878, t. 8, f. 10; Engl. & Prantl, Pflan. iii. pt. 4, f. 152A–J.

Vernac. names.—Ogwango or Ogwangu (Benin, *Thompson*); Gadeau (Yoruba, *Thompson*); Kail (French Guinea, *Pobéguin*); Cail (Senegambia, Kew Bull. 1890, p. 169); Dubin or Dubini (Gold Coast, *De Rothschild*, *Johnson*); Bele (Golo, Sudan, Bull. Imp. Inst. 1909, p. 21).—Cail-Cedra (French); African Mahogany.

All Provinces, S. Nigeria; Zungeru, Katagum, Guarara River, in N. Nigeria, and widely distributed in Tropical Africa.

African Mahogany includes several species of widely different origin to those already mentioned under *Meliaceae*. There is little doubt, however, that it was the wood of this species which first found its way into commerce as West African Mahogany. The Liverpool trade in the wood originated on the Gambia, from which colony specimens were first sent to Kew and proved to be *Khaya senegalensis*. According to Mr. James Irvine the export began in the autumn of 1886 with about 250 tons (Kew Bull. 1894, p. 8); by 1895 the trade had increased to such an extent that the important mahogany industries of British Honduras and neighbouring countries were seriously affected; shipments were also then being made to the United States (Kew Bull. 1895, p. 80). In 1904 the trade in the West African wood was on such a scale that it could be stated (Timber Trades Journal, 1904, p. 571), "It has made this country largely independent of the production of the West Indies, and it is in this direction that we now and in the future will have to rely for our importations of mahogany." Of a total import (in 1903) from all sources of about 20,000,000 feet, nearly 18,000,000 feet was received from West Africa (Chaloner's Report, Liverpool, Jan. 2nd, 1905). The development of the trade with Southern Nigeria and the United Kingdom is shown in the accompanying chart, compiled from Annual Statements of the Trade of the United Kingdom prepared at the Custom House. The figures are given under Lagos and Niger Protectorates throughout for the 14 years represented.

In 1908 the exports from N. and S. Nigeria amounted to 28,750 tons, value £260,994 (Trade of the United Kingdom, i. 1909, p. 281).

The proportion in which the total exports from S. Nigeria are distributed to various countries is shewn in the following figures taken from S. Nigeria Govt. Gaz. Extraordinary, July 3rd, 1908, App. B, p. 932:—

		Quantity.			Value.		
		Logs.		c. ft.	£		£
1906	United Kingdom ...	12,864	+	552,708	44,913	+	11,360
	Germany	2,488	+	8,587	11,893	+	416
	Other Countries ...	382		—	136		—
1907	United Kingdom ...	14,500	+	170,652	51,731	+	6,128
	Germany	2,737	+	5,376	11,103	+	279
	Other Countries ...	—		—	—		—

The proportion of the total export from S. Nigeria attributed to each province is shown in the following figures (l.c. Appendices B, i. ii. and iii.) :—

		Quantity.		Value.	
		Logs.	c. ft.	£	£
1906	W. Prov.	1,566 +	533,943	8,975 +	10,209
	Cent. Prov.	14,067 +	27,067	47,467 +	1,560
	E. Prov.	101 +	285	499 +	8
1907	W. Prov.	1,465 +	162,823	7,637 +	5,825
	Cent. Prov.	15,772 +	6,265	55,197 +	462
	E. Prov.	—	7,300	—	120

The trade descriptions would be Benin Mahogany, Sapele Mahogany, Lagos Mahogany, etc., following the port of shipment. According to a recent trade report (Chaloner & Co., Liverpool, Jan. 1st, 1906), the total supply of Mahogany from the West Coast of Africa during 1905 was 16,965,137 feet, of which the proportion from Southern Nigerian ports is shown in the following figures :—

	Feet.		Logs.
Benin	3,889,809	=	6,488
Lagos	1,978,060	=	3,629
Sapele	896,772	=	1,109
Bakana	58,521	=	58

The value of Lagos Mahogany (1st Jan., 1906) was 3¼*d.* to 7*d.* per foot of 1-inch, and that of African Mahogany 3¼*d.* to 8*d.* (l.c.) ; exactly the same prices were recorded for 1905 (l.c.), and this would appear to be about the normal value of West African Mahogany. Some big prices have occasionally been given for logs. According to the Timber News (Feb. 18th, 1889, p. 31) a finely figured log was sold at Messrs. Edward Chaloner & Co.'s sale, the 10th Feb., 1889, for £408 5*s.* 8*d.* (3*s.* 8*d.* per foot), and the Timber Trades Journal (March 12th, 1904, p. 571) recorded the sale on the 28th Nov., 1903, by the same firm, of a log which realized the remarkable price of £1,046 5*s.* (12*s.* 6*d.* per foot).

It is of interest to note the difference in the supply price, prime cost of production or export price, and the demand or import price on the wholesale markets of the United Kingdom. Taking, for example, the year 1907, the return in value of the quantities shipped from S. Nigeria to the United Kingdom, expressed in tons (Trade of the Unit. Kingdom, i. 1908, p. 264), is £254,848, and the return in value of the quantities, which it may be fairly assumed are the same, though expressed in logs and cubic feet (S. Nig. Gov. Gaz., l.c.), is £57,859. These figures show a difference of £196,989, or nearly £200,000 to be accounted for in freight, market and other charges, and profits.

The wood cuts out into very fine planks, and for joinery and cabinet work it is most valuable. It has much the appearance in colour of the Spanish or Honduras Mahogany (*Swietenia Mahagoni*), but rather softer, with a less compact grain (Kew Bull. 1890, p. 168).

Canoes made of Mahogany are common in the waters of Degema and Brass, where a large trade is done in them with other parts of the colony.

A series of tests with Mahogany and other woods from Lagos, were made by the Admiralty at the Chatham Dockyard in 1897, the results of which are published in the correspondence relating to Botanical and Forestry Matters in West Africa, 1889–1901, Colonial Office, p. 83. The specimens to which these tests related, were transferred from the Museum of the Royal Botanic Gardens, Kew, to the Imperial Institute in March, 1905.

A sample of Lagos Mahogany in the Kew Museum has a specific gravity ·51, weight per cubic foot 31·5 lbs.; Sapele Mahogany, sp. gr. ·61, weight per cubic foot 38·125 lbs.; Benin Mahogany, sp. gr. ·516, weight per cubic foot 32·5 lbs. The specific gravity was estimated by experiment and the weight per cubic foot by calculation. A sample of "ogwango" examined for the Imperial Institute weighed 32 lbs. per cubic foot (*See* Bull. Imp. Inst. 1908, pp. 147 and 152, where the wood is reported on by Mr. Herbert Stone, and a series of "mechanical" tests recorded, as carried out by Professors Unwin and Dalby).

A specimen of the wood of Gambia Mahogany in the Kew Museum has a specific gravity of ·7935, equivalent to an approximate weight per cubic foot of 49·5 lbs.; this wood is without doubt that of *Khaya senegalensis*; it was sent to Kew by Sir Gilbert Carter in 1890, with the herbarium specimens on which the name was determined. In another sample of the wood of *Khaya senegalensis* from the Gold Coast the specific gravity is ·4847, and the approximate weight per cubic foot, 30 lbs. (Mus. Kew).

The tree appears to be of little importance beyond its value for timber. The gum has been used as a substitute or an adulterant of the Gum Arabic of commerce, but it has little or no value. A sample from Sierra Leone, submitted to Kew in 1890, was stated to be of little strength, and a consignment would not be likely to realize sufficient to cover freight and charges (Mus. Kew).

The bark is bitter, and is used by the natives as a febrifuge.

The tree is propagated by means of seeds. The natural and artificial regeneration of this tree with other species of African Mahogany mentioned, receives special attention by the Forestry Department in all Forest Reserves (*see* p. 40), and the protection of standing trees is provided for in the Forestry Proclamations mentioned on pp. 45 and 46.

Ref.—"Gambia Mahogany" in Kew Bull. 1890, pp. 168–170.—"West African Mahogany," l.c. 1894, pp. 8–9.—"Ecorce de Cail Cedra," in Les Drog. Simpl. d'origine vegetale, Planchon and Collin, ii. pp. 668–670 (Octave Doin, Paris, 1896).—"Afrikanisches Mahagoni" in Der Tropenpflanzer i. 1897, pp. 317–318.—"Report on the Mahogany found near the Ramos River in the Warri and Forcados Districts," Unwin, in Suppl. to S. Nigeria Gazette, Dec. 11th, 1907, pp. 1–3.

PSEUDOCEDRELA, Harms.

Pseudrocedrela Kotschyi, *Harms*, in Bot. Jahrb. xxii. (1895), p. 154.

Ill.—Notizbl. Bot. Gart. Berlin, V. 1909, f. 9.

A tree, usually 20–30 ft. high, occasionally much taller. Leaves paripinnate or imparipinnate, 1 ft. or more long; leaflets 5–9 pairs, subsessile, straight or slightly curved, oblong or oblong-lanceolate, obtuse at the apex, rounded, truncate or subcordate at the base, 2½–6 in. long, 1–2 in. broad, margin wavy, in a young state pubescent on both surfaces, the upper surface eventually becoming glabrous and shining. Panicles axillary, many-flowered, 6–8 in. long. Sepals 4–5, ovate or ovate-oblong, connate at the base. Petals 4–5, oblong-spathulate. Staminal tube urceolate, about half as long as the petals, 5-lobed above; lobes 2-toothed, bearing an anther between the teeth. Discus fleshy, cupular. Ovary 5-celled; ovules several in each cell; style short, cylindric; stigma discoid. Capsule erect, oblong, 3–4 in. long, splitting septicidally into 5 valves from the apex downwards; valves joined by a fibrous network; central column 5-angled. Seeds about 5 in each cell, winged below.

Vernac. names.—Tonam (Katagum, *Dalziel*); Alu (Togoland, Tropenpflan. x. 1906, Beihefte, p. 253).

Jebba, Nupe in N. Nigeria; S. Nigeria.

Described as possessing a very pretty wood; found in the dry open forests of S. Nigeria (Thompson, Col. Rep. Misc. No. 51, 1908, p. 63). Yields a dark coloured gum saleable at a low price (Dunstan, Col. Rep. Ann. No. 601, 1909, p. 43).

CHAILLETIACEAE.

CHAILLETIA, DC.

Chailletia toxicaria, *G. Don*; Fl. Trop. Afr. I. p. 341.

Vernac. names.—Mémé (Kafogo, Sierra Leone, *Scott Elliott*); Manunk (Sierra Leone, *Smythe*); Magberi (Mendi, Sierra Leone, *Renner*); Manak (Timne, Sierra Leone, *Renner*).—Ratsbane; Broke-Back.

Found throughout West Africa.

The seeds of this plant are used in West Africa, Sierra Leone more particularly, for destroying rats. They are sold in Freetown Market (Smythe, Herb. Kew). The plant is also regarded as being one of the sources of the many mysterious poisons used in West Africa. It is a common form of punishment, ordeal and means of revenge. The poisons find their best use in the destruction of obnoxious animals, but in certain cases, *Tephrosia Vogelii* (q.v.) for instance, they can be used to obtain food by poisoning fish, &c., without any serious effects.

According to Dr. Renner it is used amongst the Timnes and Mendis to poison well-water and streams which supply hostile villages. Domestic animals poisoned by it rush about in great excitement, as if in severe pain, they vomit and drag their hind legs, which ultimately become paralysed (Journ. African Soc. Oct. 1904, p. 111). On a specimen collected by Dr. Kirk, an antidote for this poison is said to be a pint of water (Herb. Kew).

A chemical and physiological examination of the fruit, conducted by Dr. Power and Messrs. Tutin and Dale, at the Wellcome Chemical Research Laboratories, shows that it contains no alkaloid, cyanogenitic glucoside or soluble proteid, to which its highly poisonous properties could be attributed. It has been found that it contains at least two active principles, one of which causes cerebral depression or narcosis, and the other cerebral excitation, leading to epileptiform convulsions; that the poison which causes convulsions is very slowly excreted, so that a cumulative effect is produced by the administration of a series of individually innocuous doses (Chem. & Physiol. Ex. *Chailletia toxicaria*, pp. 1181, 1183). Although the genus is an extensive one, the only other species of *Chailletia* that has so far been proved to be poisonous is *C. cymosa*, which has been found poisonous to trek oxen in the Transvaal (Kew Bull. 1901, p. 101).

Ref.—"Native Poison, West Africa," Dr. Renner, in Journ. African Soc. Oct. 1904, pp. 109–111.—Chemical and Physiological examination of the Fruit of Chailletia toxicaria, Dr. Power, and F. Tutin, pp. 1171–1183, No. 63, Wellcome Chemical Research Laboratories; a Reprint from Journ. American Chemical Soc. xxviii. Sept. 1906.

OLACINEAE.

XIMENIA, Linn.

Ximenia americana, *Linn.*; Fl. Trop. Afr. I. p. 346.

Ill.—Plumier, Nov. Gen. Amer. t. 21 (*X. aculeata*); Plumier, Ic. Burm. t. 261 (*X. aculeata*); Aublet, Guiana, t. 125 (*Heymassoli spinosa*); Jacq. Icon. Select. Stirp. Amer. t. 177, f. 31 (*X. multiflora*); Lam. Encycl. t. 297, f. 1; Desc. Ant. ii. t. 132; Baillon, Adansonia, ii. t. 9, ff. 5–6 (flowers); Nuttall, N. Amer. Sylva, i. t. 36; Schnizlein, Ic. t. 223, f. 1; Giornale Bot. Italiano, Pisa, ix. t. 11, ff. 1–11; Mart. Fl. Bras. xii. pt. 2, t. 2, f. 1; Pierre, Fl. For. Cochin, t. 265 A.; Engl. & Prantl, Pflan. iii. pt. 1, f. 150 A–B (flowers, &c. from Nature), C–F (fruits, &c. after Beccari); Ann. Inst. Col. Marseille, v. 1898, "Graines, Grasses," &c. p. 29, f. 5 (kernels and seed), p. 31, f. 6 (young plant in pot), p. 32, f. 7 (fruit), p. 33, f. 8 (after Engl. & Prantl, l.c.).

Vernac. names.—Igo (Lagos, *Macgregor*); Osere (Lagos, *Dawodu*); Muhinge or Mohinge (Golungo Alto, *Welwitsch*); Umpeque (Mossamedes, *Welwitsch*); Elozy-Zégué (Gaboon, *Heckel*); Alimu (Sudan, Bull. Imp. Inst. 1907, p. 359); Alankoawe (Arabic, *Muriel*); Bibi (Hameg, *Muriel*).—Wild Olive; Wild Lime; Mountain Plum; Seaside Plum; Hog Plum; Citron of the Sea; Tallow Nut; Sennet.

Niger; Lagos; Yoruba; widely distributed in Tropical Africa, India, Burma, Ceylon, Florida, Brazil, West Indies and Tropics generally.

The fruit is edible, about the size and shape of an olive. It has been described by various writers as having "a peculiar aromatic flavour and delicious perfume" (Bull. Bot. Dept. Jamaica); "smell of cyanic acid" (Welwitsch); "flavour like a citron and nearly as sour as anything in nature" (Schweinfurth); "watery pulp of a pleasant sweet subacid taste" (Nuttall). This variety of opinion appears to fit the common names enumerated above, but it is singular that according to Welwitsch no animal touches the fruit. In Guam, however, it is said to be much relished by the fruit pigeons (Safford, Pl. Guam, p. 399).

It is useful in cases of habitual constipation and gastric troubles, when the irritating action of drastic purgatives has to be avoided (Bull. Bot. Dept. Jamaica, 1898, p. 74). In Golungo Alto the crushed rind is frequently applied to the sores of domestic animals to keep off flies (Hiern, Cat. Welw. Afr. Pl. i. p. 141). According to Sargent hydrocyanic acid can be obtained from the fruit (Woods of Unit. St. Jesup Coll. p. 11); the same property has been observed by the French in the Gaboon, and confirmed by Ernst of Caracas, near which place the plant abounds (Flückiger & Hanbury, Pharmacog. p. 250). No prussic acid can be detected in the leaves (Dunstan, Col. Rep. Ann. No. 601, 1909, p. 44).

The kernels are edible—"eaten and taste like filberts" (Gamble); "the soft nut-like kernel is eaten with the juicy pulp" (Schweinfurth); "the seeds of the fruit contain a very savoury kernel" (Welwitsch). On the other hand we find it stated, "the kernel is more strongly purgative than the fruit" (Bull. Bot. Dept. Jamaica); "the seeds are purgative" (Sébire); "not edible, even poisonous" (Pobèguin). The term edible would appear to require some qualification, and "what is one man's food is another man's poison" appears in this instance to be amply justified.

The kernels can be used in the making of a kind of Marasquino; they yield an oil which is employed by the natives of Mossamedes at the time of their feasts, also for anointing their bodies, and for daubing their hair (Hiern, Cat. Welw. Afr. Pl. i. p. 141); said to be suitable for soap-making (Moloney, For. W. Afr. p. 298). "Citron of the Sea" oil or "Elozy-Zégué"; oil is obtained from these kernels (Ann. Inst. Col. Marseille, "Graines, Grasses," &c. v. 1898, p. 27).

Heckel has obtained 69·3 per cent. of a yellow, rather thick and viscous non-drying oil (l.c. p. 36). The oil does not separate from the cake, and for commercial use would have to be extracted by means of solvents. Its chemical constitution is such that it would find a use for soap-making, especially in Europe, and in the countries of production; he suggests it might be used in the fresh state for food, on account of its agreeable flavour, provided it is extracted from such seeds as are not purgative, and this is not easy to discover from the external characters of the seed. The oil-cake made from the seed gives a fairly high percentage of albuminoid matters, and it could therefore be used at least as manure whether it be obtained from purgative or edible seeds (l.c. p. 37).

The wood is very heavy, tough, hard and close-grained. According to Sargent (Woods of Unit. St. Jesup Coll. p. 144) the specific gravity of the dry wood is 0·9196, and weight per cubic foot 57·31 lbs.; according to Gamble (Man. Ind. Timb. p. 163) the weight per cubic foot is 67 lbs.; this specimen, now in the Museum, Kew, has a specific gravity of ·915 = 57 lbs. per cubic foot, and a specimen from Singapore in the Museum, Kew, has a specific gravity of ·8927 = 56 lbs. per cubic foot. It is used according to Gamble (l.c.) as a substitute for sandal-wood by Brahmins in their religious ceremonies.

The bark of this tree has recently been examined at the Imperial Institute in respect of its value as a tanning material.

The sample was received (December, 1906) from Khartum under the native name "Alimu." It consisted of small pieces of reddish-brown bark, which was rather fibrous, and covered with a rough dark coloured scale.

The analysis gave :—Moisture, 9·77 per cent. ; ash, 6·70 per cent. ; tannin, 16·9 per cent. ; extractive matter (non-tannin) 6·0 per cent.

The bark furnishes a soft leather with a rather reddish colour (Bull. Imp. Inst. 1907, p. 359).

The tree appears to be fairly abundant everywhere, and judging by its wide distribution can be very easily propagated by seed, but unless the value of the oil for use, perhaps in soap manufacture, or the importance of the bark as a tanning material, can be extended, it seems open to question whether the cultivation of the tree would be worthy of more than ordinary attention.

Ref.—"Huile de Citron de Mer ou d'Elozy-Zégué," in "Graines Grasses Nouvelles ou peu connues des Col. Franç., Ann. Inst. Col. Marseille, v. 1898, pp. 27–39.

COULA, Baillon.

Coula edulis, *Baill.* ; Fl. Trop. Afr. I. p. 351.

Ill.—Baillon, Adansonia, iii. t. 3 ; Ann. Inst. Col. Marseille, v. 1898, p. 6, f. 1 (fruits).

Vernac. names.—Coula (Gaboon, *Heckel*) ; Koumounou (Loango, *Heckel*) ; Koumongou, Igoumon (Congo, *De Wildeman*) ; Noyer du Gabon (*Sebire*).

Widely distributed in West Africa.

The kernels are edible, and when cooked, *i.e.*, boiled in the nut, make an agreeable dessert nut.

A sample of these nuts was submitted by Kew, in July, 1905, to Messrs. Praschkauer & Co., London, for commercial valuation, who reported that, owing to the shell, they are impossible for oil crushing ; the kernel also was very much shrivelled and partly decayed. If they could be sent over shelled the kernels would be worth about £7 per ton (Mus. Kew).

A firm in Liverpool has examined the nuts, and is of opinion that they would yield a very nice edible oil. Some difficulty was found in obtaining a sufficient quantity (2 tons or so) to estimate the value on a commercial scale (l.c.).

Sébire (Pl. Util. Sénégal, p. 47) mentions that the nut is edible, and that it furnishes a good percentage of edible oil. Heckel in 1898 regarded the oil as a scientific curiosity, but, like the oil of Ben, by reason of its delicacy and freedom from rancidity, it was suggested that it would be useful for oiling clocks and watches. He considered the proportion of oil in the seed too small to be exploited profitably on a commercial scale for any large industry such as soap-making (Ann. Inst. Col. Marseille, v. 1898, p. 11).

The wood is hard and reddish in colour ; suitable for wheelwright's work and turnery (De Wildeman, Pl. Util. Congo, 1904, p. 337).

Ref.—"Huile de Coula ou de Koumounou" Coula edulis, in "Graines Grasses Nouvelles ou peu connues des Col. Franç.," Ann. Inst. Col. Marseille, v. 1898, pp. 1–11.

CELASTRINEAE.

GYMNOSPORIA, Benth. & Hook.

Gymnosporia senegalensis, *Loes.* in Engl. Bot. Jahrb. xvii. (1893), p. 541.

[*Celastrus senegalensis*, Lam., Fl. Trop. Afr. i. p. 361.]

Var. **inermis,** *Loes.*, has been collected in Lagos [(Rowland), (Millen No. 117) Herb. Kew]; in Borgu (Barter, No. 780 Herb. Kew), and in Northern Nigeria without precise locality (Talbot, Herb. Kew).

Ill.—Guillem. Perr. Rich. Fl. Senegamb. t. 36 (*Celastrus coriaceus*); Wight, Ic. Pl. Ind. or. ii. t. 382 (*Celastrus montanus*); Boissier, Voy. de Bot. Espagne, t. 38 (*Celastrus europaeus*); Bedd. Fl. Sylv. (Anal. Gen.) t. 10, f. 2 (*C. senegalensis*); Vidal Fl. For. Filip. t. 31A (*C. montana*).

Vernac. name.—Guenoudeck (Senegal, *Moloney*).

Borgu; Kano. Widely distributed in Tropical Africa; extending to India and occurring in the Mediterranean region.

In India the leaves are used for fodder, the branches as dunnage for the roofs of houses (Gamble, Man. Ind. Timb. p. 177), and the bark ground to a paste—mixed with mustard oil—as a dressing for the head (Dict. Econ. Prod. Ind.).

The natives of Senegal and Senegambia use the root bark in the treatment of chronic dysentery (Moloney, For. W. Afr. p. 299; Sébire, Pl. Util. Sénégal, p. 48). In Madi a decoction of the root is used to relieve pain at childbirth (Grant, Trans. Linn. Soc. xxix. p. 46).

The wood is closed grained, hard and durable (Moloney, For. W. Afr. p. 298). According to Gamble it weighs 45 lb. per cubic foot, and the tree is found in India at altitudes up to 4000 feet (Man. Ind. Timbers, p. 177).

HIPPOCRATEA, Linn.

Hippocratea indica, *Willd.*; Fl. Trop. Afr. I. p. 368.

Ill.—Roxb. Pl. Corom. ii. t. 130; Pierre, Fl. For. Cochin, t. 302; Brandis, Ind. Trees, p. 160.

Vernac. name.—N'Gunbo (Golungo Alto, *Welwitsch*).

Niger; Nupe. Widely distributed in Tropical Africa, India, etc.

The very tough and twisted stem of this liane is used by the natives of Angola for the construction of pig-sties, the toughness of the stems offering a greater resistance to the pigs' teeth than other building woods (Hiern, Cat. Welw. Afr. Pl. i. p. 148).

Hippocratea obtusifolia, *Roxb.*; Fl. Trop. Afr. I. p. 369.

Ill.—Guillem. Perr. Rich. Fl. Senegamb. t. 26 (*H. Richardiana*); Hook. Bot. Misc. iii. 1833, Suppl. t. 36 (*Salacia laevigata*); Blanco, Fl. Filip. t. 86 (*Salacia sinensis*); Wight Ic. Pl. Ind. or. iii. t. 963; Rich. Tent. Fl. Abyss. t. 22 (*H. Schimperiana*).

Vernac. names.—Gwodeyi (Katagum, *Dalziel*); M'Comvay (Bahr-el-Ghazal, *Brown*); Tonke (Sierra Leone, *Scott Elliott*).

Nupe; Katagum.

In Sierra Leone the root is used in the preparation of djendjeng—a native drink (Scott Elliott, Herb. Kew); stem used as tie tie, and not eaten by white ants (Dalziel, Herb. Kew).

SALACIA, Linn.

Salacia macrocarpa, *Welw.*; Fl. Trop. Afr. I. p. 373.

Old Calabar; found also in other parts of Upper and Lower Guinea.

Fruit stated to be edible (Hiern. Cat. Welw. Afr. Pl. i. p. 150).

Salacia senegalensis, DC., Fl. Trop. Afr. I. p. 374.

Ill.—Guillem. Perr. Rich. Fl. Senegamb. t. 27.

Vernac. name.—Kibbil (Yoloff, *Barter*).—Beacon Bush.

Native Fruit (Barter, Herb. Kew).

RHAMNEAE.

ZIZYPHUS, Juss.

Zizyphus Jujuba, *Lam.*; Fl. Trop. Afr. I. p. 379.

Ill.—Rheede, Hort. Mal. iv. t. 41; Sonnerat, Nouv. Guinée, t. 94 (La Manssanas); Hook. Kew Journ. Bot. i. 1834, t. 140; Blanco, Fl. Filip. t. 59; Wight, Ic. Pl. Ind. or. i. t. 99; Table Fruits of India, (Ballin & Co., Calcutta, 1842) t. 3; Brandis, Illustr. For. Fl. India, t. 17; Bedd. Fl. Sylv. t. 149; Vidal, Fl. For. Filip. t. 32B.; Sem. Hort. 1899, p. 447; Cat. Pl. Hort. Col. Brux. p. 120; Sim, For. Fl. Port. E. Afr. t. 24, f. A.

Vernac. names.—Kurna (Kontagora, *Dalziel*); Kalembo, M'Konazee (Madi, *Grant*); Masson (Mauritius, *Bouton*); Massao or Massaou (Zambesi, *Kirk*, *Meller*); Bhere or Ber (India, Kew Bull. 1889, p. 23).—Indian Jujube; Chinese Date; Egg Plum.

Niger; Kontagora; Katagum; throughout Tropical Africa and in many other tropical countries.

The fruit preserved in syrup forms an important food in China and other Eastern Countries. The fruits are also often dried and they have occasionally come into the London market. The fruit is sold in the markets of Khartoum and Berber (Grant, Trans. Linn. Soc. xxix. p. 47). In Abyssinia the fruit is pounded and made into a ball. The mashed fruit is thrown into the water for the purpose of bringing fish to the surface (l.c.). The leaves are good fodder for camels and goats (Gamble, Man. Ind. Timb. p. 181); Grant (l.c.) also states that goats are very fond of the leaves. The Tusar Silkworm (*Antheroea paphia*, Linn.) is fed on the leaves, and sometimes also the Eri silkworm in Assam (Gamble, l.c.). The lac insect (*Coccus lacca*) lives on the twigs of this tree (Mus. Kew).

The root bark is used in India for tanning (l.c.), a decoction of the root for fever, and the powdered root as a dressing for ulcers and old wounds (Dict. Econ. Prod. Ind.). The bark is said to be a remedy for diarrhoea (l.c.). The tree coppices well and makes good fuel and charcoal. The wood is used for saddle trees, agricultural implements, sandals, bedstead legs, tent-pegs, oil-mills, golf clubs, and other purposes (Gamble. l c.).

Some experiments on the wood from Ceylon made by Prof. Unwin for the Imperial Institute, gave the following results :—Weight per cubic foot 48·87 lbs ; resistance to shearing along the fibres 1013·4 lbs. per sq. inch ; crushing stress 2·778 tons per sq. inch ; coefficient of transverse strength 3·479 tons per sq. inch ; coefficient of elasticity 426·7 tons per sq. inch. (Tech. Rep. & Sci. Papers, Imp. Inst. pp. 249, 259, 260, 262, and Circ. No. 20, ii. 1904, p .331, Roy. Bot. Gdn. Ceylon). According to Beddome the wood, unseasoned, weighs 72–75 lbs. per cubic foot, and seasoned 58 lbs. per cubic foot (Fl. Sylv. No. 149).

The tree is easily propagated by seed, grows freely and quickly, and succeeds in comparatively poor soil. It grows readily and seems to delight in the most arid soil, requiring no particular treatment (Bouton, Hook. Journ. Bot. i. p. 320). According to Grant, hedges are made of the thorny branches in parts of Central Africa (Trans. Linn. Soc. xxix. p. 47). In parts of West Africa it is used for a similar purpose. Under cultivation the fruit is much improved and there are several varieties, differing greatly in the shape and size of the leaves as also in the size and nature of the fruit. Of the fruits cultivated in Mauritius, Bouton (l.c.) has distinguished between varieties with the flesh adhering or not adhering to the nut. The variety *Hysudricus* is considered the most remarkable, and this according to Aitchison is always raised by grafting (Kew Bull. 1889, p. 23). Young plants are propagated and sold regularly by the Botanical Department at Oloke-Meji.

Ref.—"Observations on the different varieties of Zizyphus Jujuba cultivated in the Mauritius," Bouton, in Hook. Journ. Bot. i. 1834, pp. 319–322.—"Ilanthai," in Colonial Timbers, Tech. Rep. & Sci. Papers, Imp. Inst. 1903, pp. 249, 259–262.

Zizyphus mucronata, *Willd.* ; Fl. Trop. Afr. I. p. 380.

Ill.—Guillem. Perr. Rich. Fl. Senegamb. t. 37 (*Z. Baclei*) ; Wood, Natal Pl. i. t. 47 ; Sim. For. Fl. Cape Col. t. 36, f. 1.

Vernac. names.—Tomburong (Gambia, *Daniell*) ; Umpafa (Katir, *Sim*) ; Buffalo Thorn (Cape, *Pappe*) ; Cut Thorn (Cape, *Sim*).

Lagos ; Jebba ; Nupe ; Attah ; Bornu ; and throughout Tropical Africa extending to the Cape.

Fruit edible. It is believed to be the Lotus mentioned by Mungo Park as being used for making into bread, which tastes like ginger-bread, and also for the preparation of a pleasant beverage (*Z. Baclei* in Treas. Botany). In S. Africa a paste made of the leaves is applied to glandular swellings. A decoction of the root is used in lumbago and taken internally for all scrofulous diseases and for swollen glands of the neck (Smith, Contr. to S. Afr. Mat. Med. pp. 88, 136).

The wood is tough and used chiefly for wagon work (Pappe, Silva Capensis, p. 12) ; very little used except for yoke-keys (Sim. For. Fl. Cape Col. p. 178).

The seeds are used by Musselmen to make rosaries (Barter, Mus. Kew).

In Cape Colony the plant is occasionally used for hedges, but does not stand trimming well ; it requires deep alluvial soil (Sim, l.c.).

Zizyphus Spina-Christi, *Willd.*; Fl. Trop. Afr. I. p. 380.

Vernac. name.—Ailb (Hadramaut, *Lunt*).

Nupe Rabba; banks of Komadugu Waube, Dumjiri, N. Bornu.

Fruit edible, with an agreeable flavour (Moloney, For. W. Afr. p. 300).

The wood is hard, compact and heavy, considered a cabinet wood of the first quality (Grisard & Vanden Berghe, Les Bois Indust. Indig. Exot. p. 338).

AMPELIDEAE.

VITIS, Linn.

Vitis aralioides, Welw.; Fl. Trop. Afr. I. p. 411.

[*Cissus aralioides*, Planchon, Monogr. Ampelid. p. 513.]

Nupe.

Fruit edible; a remarkable ornament when in fruit; grows in damp, dense, primitive woods, and favours especially riverside trees (Hiern, Cat. Welw. Afr. Pl. i. p. 160).

Vitis bombycina, *Baker*; Fl. Trop. Afr. I. p. 399.

[*Ampelocissus bombycina*, Planch. Monogr. Ampelid. p. 383.]

Niger; Nupe.

Fruit eatable.

Vitis caesia, *Sabine*; Fl. Trop. Afr. I. p. 396.

[*Cissus caesia*, Afzel.; Planch. Monogr. Ampelid. p. 485.]

Vernac. name.—Abekau Maru (Lagos, *Phillips*).

Nupe; Lagos.

Country Grapes (Sierra Leone, *Don*, *Moloney*).

The ripe fruits are acid and not very agreeable to Europeans, but are eaten by Negroes (Don, Hist. Dich. Pl. i. p. 710; Moloney, For. W. Afr. p. 301).

Vitis cornifolia, *Baker*; Fl. Trop. Afr. I. p. 390.

[*Cissus cornifolia*, Planch. Monogr. Ampelid. p. 492.]

Ill.—Trans. Linn. Soc. xxix. t. 22.

Vernac. name.—Rigar biri (Katagum, *Dalziel*); M'pungee-pungee (Madi, *Grant*).

Nupe; Katagum.

Fruit edible (Fl. Trop. Afr. l c.) but not pleasant to eat (Grant, Trans. Linn. Soc. xxix. p. 47); flowering in November; ripe at Madi in December.

Vitis Lecardii, *Carriere*, Rev. Hort. 1881, p. 456.

[*Ampelocissus Lecardii*, Planch. Monogr. Ampelid. p. 386.]

Ill.—Rev. Hort. 1881, p. 455; Fl. des Serres, t. 2452–3.

Soudan Vine; La Vigne de Nigritie (Carriere, Rev. Hort. 1881, p. 205).

Banks of R. Niger, Hinterland of Sierra Leone 12° and 13° N. lat. (Gard. Chron. January 1st, 1881, p. 18). Senegambia (Planchon l.c.).

Fruits edible ; the best *Vitis* in Tropical Africa.

M. Lecard, the discoverer, describes the fruit as excellent and abundant.

It was suggested that this vine might prove useful for stocks in the vine growing countries where *Phylloxera* was abundant, but it has been found in no way superior to American stocks.

Ref.—"Les Vignes du Soudan," Carriere, in Revue Horticole, 1881, pp. 352-355 ; 413–417 and 454–458.—Les Vignes du Soudan, Lavallée, pp. 1–13 ; Soc. Nat. d'Agric. France (Bouchard-Huzard, Paris, 1881).

Vitis Leonensis, *Hook. f.* ; Fl. Trop. Afr. I. p. 398.

[*Ampelocissus leonensis*, Planch. in Journ. la Vigne, Amer. Jan. 1885, p. 30 ; Monogr. Ampelid. p. 387.]

Nupe.

Fruits red, edible.

Vitis pallida, *Wight & Arn.* ; Fl. Trop. Afr. I. p. 393, in part.

[*Cissus populnea*, Guill. et Perr. ; Planch. Monogr. Ampelid. p. 479.]

Vernac. name.—Dafara (Katagum, *Dalziel*).

Lagos ; Nupe ; Katagum.

Bark used to give viscid solution, mixed with native cement (Dalziel, Herb. Kew).

Vitis palmatifida, *Baker* ; Fl. Trop. Afr. I. p. 397.

[*Cissus palmatifida*, Planch. Monogr. Ampelid. p. 473.]

Niger ; Nupe.

Fruits edible—like black currants.

Vitis quadrangularis, Linn. ; Fl. Trop. Afr. I. p. 399.

[*Cissus quadrangularis*, Planch. Monogr. Ampelid. p. 509.]

Ill.—Rheede, Hort. Mal. vii. t. 41 ; Wight. Ic. Pl. Ind. or. i. t. 51 ; Wood, Natal Pl. iv. t. 393.

Vernac. names.—Sassarau Kura (Katagum, *Dalziel*) ; Meeoleh-oleh (Unyoro, *Grant*).—Edible Stemmed Vine.

Nupe ; Katagum ; widely distributed in Tropical Africa. Occurs also in Arabia, India, Ceylon, etc.

Fruit edible.

In India the stems are eaten by the natives in curries ; they become very acid with age.

The leaves and young shoots, dried and powdered, are given in bowel complaints (Dict. Econ. Prod. Ind.).

Generally found trailing over trees and bushes ; in rocky places, Nupe (Barter, Herb. Kew) ; on the mounds of the white ant in Senegambia (Fl. Trop. Afr. i. p. 400).

Vitis Schimperiana, *Baker*; Fl. Trop. Afr. I. p. 395, in part. [*Ampelocissus Bakeri*, Planch. Monogr. Ampelid. p. 385.]

Forest Grapes.

Yoruba, and Togoland.

Fruit like that of the Frontignac Grape (Barter, Herb. Kew), edible.

There are many other species of Vitis in Tropical Africa, and it is probable that more occur in Nigeria, with so-called edible fruit. Some species, especially *Vitis pruriens*, Welw. (Fl. Trop. Afr. i. p. 408) [*Cissus pruriens*, Planch. Monogr. Ampelid. p. 595], have very attractive fruits, but dangerous because they are covered with small stinging hairs, which cause a burning and itching sensation in the throat. McNair mentions a grape-vine called "Siling-Silame" (Hausa) and "Eteku" (Yoruba) which grows plentifully in all the Hausa country; the bark and leaves are used by the Hausas as a medicine, in the form of a decoction, for fever. The fruit is sour, but is eaten by the native shepherds when they are very hungry (Rep. Bot. St. Lagos, 31st March, 1890.)

LEEA, Linn.

Leea sambucina, *Willd.*; Fl. Trop. Afr. I. p. 415.

[*Leea guineensis*, Don.]

Ill.—Rumpf, Amb. iv. t. 45; Banks & Solander, Bot. Cook's Voy. i. t. 41A; Blanco, Fl. Filip. t. 60; Vidal, Fl. For. Filip. t. 33A.

Vernac. names.—Aledo (Lagos, *Dawodu*); Bois de Sureau (Reunion, *Watt*).

Lagos; Abeokuta; Onitsha; widely distributed in Tropical Africa, India, Burma, Ceylon, Polynesia, etc.

A decoction of the root is cooling and relieves thirst; in India it is given in colic, and in Reunion used as a sudorific (Dict. Econ. Prod. Ind.). The roasted leaves are applied to the head in vertigo, and the juice of the young leaves is digestive. The plant is described as one of the greatest ornaments of the forest (Fl. Trop. Afr. i. p. 415).

SAPINDACEAE.

CARDIOSPERMUM, Linn.

Cardiospermum Halicacabum, *Linn.*; Fl. Trop. Afr. I. p. 417.

Ill.—Rheede, Hort. Mal. viii. t. 28; Rumpf, Amb. vi. t. 24; Gaertn. Fruct. Sem. Pl. i. t. 79 (flower); Lam. Encycl. t. 317, f. 2; Bot. Mag. t. 1049; Desc. Ant. iv. t. 241; Mem. Mus. Paris, xviii. 1829, t. 1, f. A; Wight, Ic. Pl. Ind. or. ii. t. 508; Gray, Gen. t. 181; Schnizlein, Ic. t. 230.

Vernac. names.—M'niolola (Unyoro, *Grant*); Iyantishmati (Sanskrit, *Dymock*).—Balloon Vine; Heart Pea; Heart Seed; Smooth Heart Seed; Winter Cherry.

Lagos; widely distributed in Trop. Africa and throughout the Tropics.

The root is described as possessing emetic, laxative, stomachic, and rubefacient properties ; prescribed for rheumatism, nervous diseases, piles, etc.

The leaves are used in amenorrhoea and, on the Malabar Coast, are administered in pulmonic complaints. The Hindus administer the leaves internally, rubbed up with castor oil, and also apply a paste made with them externally. A similar external application is used to reduce swellings and tumours of various kinds (Dymock, Pharm. Journ. [3] viii. 1878, p. 1002).

The leaves, together with the young shoots, are sometimes cooked as a vegetable. The native name in Unyoro signifies chain-like, because when the plant is boiled as a vegetable it is stringy to eat (Grant, Trans. Linn. Soc. xxix. p. 48).

The seed is used as a tonic in fever and a diaphoretic in rheumatism.

Ref.—*Cardiospermum Halicacabum* in "Notes on Indian Drugs," Dymock, in Pharm. Journ. [3] viii. 1878, p. 1002.

PAULLINIA, Linn.

Paullinia pinnata, *Linn.* ; Fl. Trop. Afr. I. p. 419.

Ill.—Gaertn. Fruct. Sem. Pl. i. t. 79 ; Lam. Encyc. t. 318.

Vernac. names.—Kakasenla (Lagos, *Dawodu*) ; Aza (S. Nigeria, *Dennett*) ; Ebanka (Sierra Leone) ; Timbo (Brazil, *Holmes*).

Old Calabar ; Zungeru ; Lokoja ; Dekina, Bassa ; widely distributed in Tropical Africa, and Tropical America.

Leaves and roots used by the natives on the Gold Coast for dysentery (Johnson, Herb. Kew).

The bark of the root is a narcotic poison. It has an aromatic odour slightly resembling musk. According to Martius it acts especially on the kidneys and brain ; he compares it to aconite and states that the natives of Brazil prepare a slow poison from it (Holmes, Pharm. Journ. [3] v. 1875, p. 986). In Brazil poultices are made from it with boiling water which are applied to the side in affections of the liver and often cause intense eruptions (Pharm. Journ. [3] vii. 1877, p. 1020). A decoction of the root more especially, is used for stupefying fish (Year Book of Pharm. 1892, p. 152), a property possessed by several Sapindaceous plants (Planchon & Collin Drog. Simpl. ii. p. 578). Timbonine is an alkaloid extract isolated by M. Martin, from the root bark.

The seeds also, according to Macfadyen possess the property of intoxicating fish (Fawcett, Econ. Prod. Jamaica, p. 60).

Found in the mixed forests (Thompson, Col. Rep. Misc. No. 51, 1908, p. 61).

Ref.—"Timbo Root" Holmes, in Pharm. Journ. [3] v. 1875, p. 986.—"Timbo, Its Properties and Composition" l.c. vii. 1877, p. 1020.—"Poisonous Constituents of Timbo," in Year Book of Pharmacy, 1892, pp. 152–153.

SCHMIDELIA, Linn.

Schmidelia africana, DC. ; Fl. Trop. Afr. I. p. 421.

Ill.—Pal. de Beauv. Fl. Ow. Ben. ii. t. 107 (*Allophylus africanus*) ; Rich. Tent. Fl. Abyss. t. 27 ; Sim, Fl. For. Cape Col. t. 33, f. 4.

Vernac. names.—Azamara ; Souaria (Fl. Trop. Afr. l.c.) ; Ije eye (Lagos, *Dawodu*) ; Wowo ? (Lagos, *Phillips*) ; Kakasemala (Lagos, *MacGregor*) ; In-Qala (Kafir, *Fourcade*, *Sim*).

Lagos ; Abeokuta ; Lokoja ; Zungeru ; Guarara River ; and many parts of tropical Africa.

The fruits are used in Abyssinia as a remedy for tape-worm ; the dried fruits are pounded, mixed with flour, and then made into cakes (Moloney, For. W. Afr. p. 302). Used (part of plant not stated) in Sierra Leone to relieve toothache and headache (Holmes, Mus. Rep. Pharm. Soc. 1895, p. 88).

The wood is described as very strong and close grained ; weight per cubic foot 46·8 lbs. (Sim, For. Fl. Cape Col. p. 170).

The tree is found on the banks of the Guarara River, in forests near Lokoja, common on the banks of the Dago River, Zungeru (Elliot, Herb. Kew), and by streams Zungeru (Dalziel, Herb. Kew).

BLIGHIA, Koenig.

Blighia sapida, *Koenig ;* Fl. Trop. Afr. I. p. 426.

Ill.—Koniga Sims, Ann. Bot. ii., 1806, tt. 16–17. Tuss. Ant. i. t. 3 (*Akeesia africana*) ; Lodd. Bot. Cab. t. 1484 ; Desc. Ant. viii. t. 560 (*Akeesia africana*).

Vernac. names.—Ishin (Lagos, *Dawodu*) ; Ishiri Jeje (Lagos, *Williams*) ; Ukpe Lorphua (S. Nigeria, *Unwin*) ; Ukpi Nufwa (Benin, *Thompson*, *Unwin*) ; Okwikwiro (Ibo, *Thompson*).—Akee Apple.

Native of West Africa ; distributed to the West Indies, abundant in Jamaica.

The flowers are fragrant and the distilled water of the flowers is used as a cosmetic by the Creole ladies in the Antilles (Desc Ant. viii. p. 157).

The white or creamy-white arillus in which the seeds are set is edible and when cooked affords a very palatable food ; salt fish and Akees form one of the most common breakfast dishes among all classes in Jamaica (Agric. News, Barbados, 1905, p. 359). Cases of poisoning by eating Akee apple are occasionally reported.

The wholesomeness of the Akee as an article of food has been examined by Mr. J. J. Bowrey, F.C.S., F.I.C., Analytical Chemist to the Government of Jamaica. He found that :—

"1. Unripe Akees if eaten freely bring on vomiting. 2. Decaying Akees are decidedly unwholesome, and may be even very poisonous. This is true of many foods. 3. Fresh ripe Akees are good and harmless food, rather rich it is true, but to most persons quite wholesome. There may be individual idiosyncrasies with regard to Akee, as there are to such usually harmless foods as mutton, duck, pork, mushrooms, &c. 4. The red membrane of the Akee, so commonly believed to be poisonous is perfectly harmless. 5. If the fruit be ripe and fresh, which can be known by its being open, the edible portion firm, and the red part bright in colour, it may be considered a good and safe food. But if the fruit be not ripe, or if there are any signs of decay, such as mouldiness or softening of the edible portion, or a dingy colour in the ordinarily red part, the fruit should not be eaten." (Kew Bull. 1892. p. 109.)

From the arillus an oil is obtained, described as a yellow, non-drying, butter-like fat at ordinary temperatures, consisting of a liquid portion, and a solid granular portion; having a peculiar odour and somewhat unpleasant taste. It has been found by Garsed to have the following characters :—

Oil.

Specific Gravity	...	at 99°–100° C. = 0·857 Water at 15·5° C. = 1
Melting Point	...	25°–35° C.
Solidifying Point	...	20° C.
Hehner Value	...	93
Saponification Value	...	194·6
Reichert Value	...	0·9
Iodine Value	...	49·1
Acid Value	...	20·1

Mixed Fatty Acids.

Specific Gravity	...	at 99°–100° C. = 0·8365
Melting Point	...	42°–46° C.
Solidifying Point	...	40°–38° C.
Saponification Value	...	207·7
Iodine Value	...	58·4

(Pharm. Journ. [4] xi. 1900, p. 691.)

In Lagos the fruits are used to stupefy fish, and are pounded before being thrown into the stream (Dawodu).

Ref.—" Notes on the Oil of Akee," Holmes, in Pharmaceutical Journal [4] xi. 1900, p. 691 ; " The Characters of Oil of Akee," Garsed, l.c. p. 691–692 ; A short extract in Year Book of Pharmacy, 1901, p. 18 ; Reprint in Bull. Bot. Dept. Jamaica, 1901, pp. 74–77.

CHYTRANTHUS, Hook. f.

Chytranthus Mannii, *Hook. f.* ; Fl. Trop. Afr. I. p. 430.

Vernac. names.—Pecego (Princes Island, *Welwitsch*) ; Pecegueiro (St. Thomas, *Welwitsch*).—Peach Tree.

Fruit edible ; eaten by the natives, Princes Island (Mann, Herb. Kew). Flowers occur near the base of the trunk.

ANACARDIACEAE.

ANAPHRENIUM, E. Mey.

Anaphrenium abyssinicum, *Hochst.* ; Engl. in DC. Monogr. Phanerog. iv. 1883, p. 357.

[*Rhus insignis*, Delile ; Fl. Trop. Afr. i. p. 437].

Ill.—Rich. Tent. Fl. Abyss. t. 32 (*Anaphrenium abyssinicum*) ; Ann. Sc. Nat. Paris, Ser. 2, xx. 1843, t. 1, f. 3 (*Ozoroa insignis*) ; De Candolle, Monogr. Phanerog. iv. t. 13, ff. 15–18.

Vernac. name.—Quitundo (Pungo Andongo, *Welwitsch*).

Nupe.

A brilliant whitish resin is contained in the branches and trunk near the base.

The natives of Pungo Andongo consider the charcoal made from the wood to be the best for use in the manufacture of the small copper and iron ornaments with which they are accustomed to adorn themselves (Hiern, Cat. Welw. Afr. Pl. i. p. 181).

MANGIFERA, Linn.

Mangifera africana, *Oliv.*; Fl. Trop. Afr. I. p. 443.

Vernac. name.—Ogwi (Benin, *Unwin*).—Wild Mango.

Benin, and found all over the Central Province and probably all over S. Nigeria, extending to N. Nigeria.

Fruit eaten by the natives; sold in the markets (Unwin, Report (MSS.) on Ec. Pl. Benin, Sept. 1907).

Mangifera indica, *Linn.*; Fl. Trop. Afr. I. p. 442.

Ill.—Rheede, Hort. Mal. iv. tt. 1 & 2; Rumpf. Amb. i. tt. 25 & 26; Jacq. Ic. Pl. Rar. ii. t. 337; Lam. Encycl. t. 138, f. 1; Andr. Rep. vi. t. 425; Tuss. Ant. ii. t. 15; Desc. Ant. i. t. 25; Nova Acta Physico-Medico Academiae, Bonn, xii. t. 37; Dict. Sc. Nat. t. 262; Spach, Suites t. 11.; L'Hort. Universel, Paris, iii. 1842, p. 193; Bot. Mag. t. 4510; Schacht, Madeira and Teneriffe, t. 4; Nooten, Fl. Java, t. 20; Schnizlein, Ic. iv. t. 245, f. 7; Bedd. Fl. Sylv. t. 162; Vidal, Fl. For. Filip. t. 36 D (flower); Zippel Ausl. Handels Nährpfl. t. 60; Pierre Fl. For. Cochin. t. 361 (vars. *compressa*, *cambodiana*); Hart, Bull. Misc. Inf. Roy. Bot. Gardens, Trinidad, 1899 (outline figures of fruits, *see* enumeration under refs.); Maries, Journ. Roy. Hort. Soc. xxvi. 1901–02, ff. 319–333 (*see* enumeration under refs.); Collins, U.S. Dept. Agric. Bull. No. 28, 1903 (*see* enumeration under refs.); U.S. Dept. Agric. Bureau Pl. Industry, Bull. No. 46, 1903, t. 1, ff. 1 & 2 (Methods of Grafting, India), f. 3 (Plants from India, showing condition of arrival in U.S.A.), t. 2 (Methods of Budding), t. 3 (Germination, 8 plantlets from one seed); Firminger, Man. Gard. India [5th ed. Cameron], t. 2 (fruit of "Gathay Mar," "Raspberry," "Chittoor," "Badame"); Woodrow, The Mango, frontispiece ("Alphonse," fruit), p. 32 ("Totapari," fruit); Contr. U.S. Nat. Herb. ix. t. 28; Freeman and Chandler, World's Comm. Prod. pp. 265, 267, 272; Torreya, New York, 1907, p. 115, f. 1 (Germinating seeds; polyembrony), p. 116, f. 2 (8 seedlings from one seed, showing the blocks of nucellus each producing a seedling); Macmillan, Trop. Agric. Ceylon, 1908 (*see* enumeration under refs.); Bull. Dept. Agric. Jamaica, i. 1909, p. 48 (Budded Mango, four years old), p. 50 ("Alphonse" Mango; budded mango "Bombay"; young plantation budded mangoes).

Mango.

Native of the East Indies and Malaya. Naturalized in Tropical America, Asia, and Africa.

In West Africa, although the fruit has a fine appearance, the characteristic flavour of turpentine is too much in evidence. The qualities of the Indian Mango are due to care in selection and hybridisation, the stock originally being the same as in Nigeria.

In December, 1898, the Government of S. Nigeria received from the Botanical Department, Jamaica, a Wardian case of the "Governor" Mango; these grew well, and have recently fruited in the Botanical Gardens at Old Calabar.

In August, 1900, 50 plants of the following varieties were received from Trinidad: No. 11, Peach, Mistake, Gordon, Malda, and Peters. Both of these consignments were transmitted through the Royal Botanic Gardens, Kew, where they were examined before being sent on to Old Calabar. Of these 36 have survived and have recently fruited.

The fruits are used in India in quantity in the manufacture of chutney, large quantities of which come into the American and English markets.

Consignments of fresh fruits from Jamaica and India have proved that the Mango can be conveyed long distances with success, but they do not appear to be much appreciated in England. It is possible that as the Mango becomes better known the trade will develop. Jamaica Mangoes may at the present time be seen in fruiterers' shops in this country (Mus. Kew).

Much will depend on selection of suitable varieties and on the condition of the fruit at the time of sale.

The "Julie" Mango has been recommended very highly for export (*see* Bull. Misc. Inf. Trinidad, 1907, p. 185, and Queensland Agric. Journ. xviii. June, 1907, p. 338). In Ceylon the "Rupee" Mango is considered the largest and one of the best; it realizes locally 20 to 25 cents each, the price for other sorts at 40 to 50 cents per dozen (Macmillan, Circ. Roy. Bot. Gard. Ceylon, iii. 1906, p. 211). The "Afooz," "Alfooz" or "Alphonse" Mango is very popular in Bombay. Other very superior sorts are "No. 11," "Peters" and "Malda." "Fuzhe," one of the best of the Buday sorts, can be bought in Calcutta in September sometimes at about 8*d.* each; it is a large, fine fruit weighing often 2 lb. Most of the good varieties fetch from 6 to 10 rupees per 100 in Durbhungah Bazaar (Maries, Journ. Roy. Hort. Soc. xxvi. 1901, p. 756).

The creation of an export trade in this fruit as it now exists in Nigeria would not be worth attempting, and it is very doubtful whether such a trade could ever be developed even with improved varieties, but there is no reason why the inhabitants of Nigeria should not in course of time enjoy the superior fruits which are cultivated in other countries.

Other uses to which parts of the tree are put are of minor importance in comparison with its fruit. The seed is used as an anthelmintic (Nat. Stand. Disp. 1905, p. 174). The dried kernels of the seeds are pickled, used in curries, or made up into other preparations. A starch may be obtained from the green fruits and kernels, similar in properties to Arrowroot (*Maranta arundinacea*).

The bark and leaves are astringent, and they yield a yellow dye of no special value. The juice of the tree is an antisyphilitic (l.c.). Piuri, a yellow colouring matter obtained from the urine of cows fed on Mango leaves, is imported into the United Kingdom from India (Mus. Kew). The bark contains tannin, and is used as such in parts of India. A sample examined at the Imperial Institute

(1902) from Demerara gave 20·6 per cent. of tannin (air-dried material) and 23·8 per cent. for material dried at 105° C. A sample from Bengal gave 13·5 per cent. of tannin, and one from Pemba was found to contain the high percentage of 49·39, calculated on dried bark. It is stated that Mango bark possesses the peculiarity of communicating to leather a red tint which is not popular with English tanners, and the material is at present little known in this country (Tech. Rep. & Sci. Papers, Imp. Inst. p. 200). It also yields a gum-resin of some medicinal value, and which, according to Aitchison, is frequently sold as gum arabic. Hooper finds that an analysis of the clean gum-resin shews the following composition :—Moisture, 4·34 ; resin, 79·16 ; gum, 14·68 ; ash, 1·66 ; loss, 0·16. A sample of gum-resin from another tree afforded 78·4 per cent. of resin (Pharm. Journ. [4] xxiv. p. 718).

In Angola the skin of the root, which is very astringent and slightly aromatic, is occasionally used in the treatment of diarrhœa and dysentery (Hiern, Cat. Welw. Afr. Pl. i. p. 174).

The wood is used for planking, doors, window frames ; packing cases for indigo, opium and tea. Weight 42 lbs. per cubic foot (Gamble, Man. Ind. Timb. p. 212).

The Mango can be readily raised from seed. Seeds soon lose their vitality and should be sown with as little delay as possible after removal from the fruit. They germinate quickly—in about a fortnight—and if sown in nurseries during the dry season about January, and kept watered, they would be ready for planting out in the following rainy season (June, July or August). They are best sown in bamboo pots or little baskets made of palm leaves. This avoids risk of injury to the roots when transplanted. A good method also is to sow at once in the position intended to be permanent, the best time being just before the commencement of the rains. In this case, however, the labour of protecting is increased until the plants are large enough to look after themselves.

The above refers more particularly to the common sort when grown for ornamental purposes, or as stocks for grafting.

The choice varieties are usually propagated by grafting on the common stock ; the inarching method, with pot-grown plants about one year old, being generally considered the most practical way. Of the improved varieties that have been found nearly always to come true from seed in Jamaica, "No. 11," "Black Mango" and "Kidney Mango" are mentioned as exceptions to the general rule (Bull. Bot. Dept. Jamaica, 1901, p. 165).

The propagation of the Mango by budding has only recently been brought into practice, and up to the present may be regarded as little more than experimental. The method has been found reliable in Jamaica ; the Director of the Botanical Department, in his Report for 1903–04, states that "trees of all sizes were budded, but it was found that as a rule the larger the trees the more readily and rapidly the bud grew."

"Without doubt the quickest way to establish a Mango Orchard would be to transplant the stumps of trees, say 6–8 inches in diameter, previously cut down to within 3 feet of the ground," budding the new shoots.

"One of the trees budded at Hope was a stump not less than 50 years old."

Harris recommends that the trees be cut down carefully to within 2 feet of the ground. The shoots are thinned out to three as near the top as possible. These he considers ready for budding when three-quarters of an inch in diameter at the base (Bull. Dept. Agric. Jamaica, 1903, p. 253).

Oliver recommends two- or three-year old seedlings and moderate-sized trees as stocks on which to bud approved varieties of the Mango, the stems selected for the reception of the buds being at least an inch in diameter (The Propagation of Tropical Fruit Trees and other Plants, Bull. No. 46, 1903, U.S. Dept. of Agric. Bur. Pl. Ind. p. 11). He illustrates the ordinary method of shield-budding, and a modification called the rectangular patch method (l.c.).

Propagation may also be effected by layering.

Grafted, budded, or layered trees come to maturity earlier by several years than do those raised from seed. Twenty to thirty feet, possibly more, will be required between each tree, when fully developed, for the coarser growing kinds, and for the finer varieties any distance from 12 or 15 feet and upwards may be required.

A tropical or sub-tropical climate; a rainfall of 50 inches and upwards; rich deep and well-drained soil suits the Mango, and is essential to good growth, more particularly in the early stages, but if the soil is over rich at the time the trees are due to fruit they are apt to produce an excess of wood.

Of greater importance than soil, perhaps, is a dry season of sufficient duration to admit of the fruiting wood being thoroughly ripened. In Singapore they do not succeed well owing to the short dry season (Derry). In moist regions, where the growth is continual, artificial means of checking it are resorted to, such as ring-barking the smaller branches, the application of salt, 10 lbs. to each tree (Woodrow, The Mango, p. 14) at the end of the rainy season, and root pruning. The latter method is perhaps the most efficacious and certainly the more practical way; although in countries like Nigeria, subject to tornado seasons, it would be necessary to guard against the possibility of uprooting.

Heavy rains at the time of flowering prevent pollination.

The tree is one of the finest for making avenues.

In the references to the literature some of the improved kinds dealt with by the various authors are mentioned. There are many excellent sorts. Maries collected in Durbhunga, N.W. Bengal, over 500 varieties, and by a judicious selection it is possible to have fruits in season for at least five months in the year. One variety—"Barmassia," the 12 months Mango—is said to be a perpetual bearer, but it is of very inferior quality (Journ. Roy. Hort. Soc. xxvi. 1901, p. 756). A variety known as the "Do-ám" is said to fruit twice in one year.

The fruit is ready for gathering when it separates easily from the tree; a slight softening near the point of attachment is also a good indication. The ripening process may be completed on shelves in cool well-ventilated buildings. As with oranges, very careful handling is necessary.

A method of preserving Mangoes and other fruits is noted in the Journal of the Jamaica Agricultural Society (1905, p. 22)—the fruit is covered with cold sterilized water, sealed in bottles, and heated for four hours at 150° to 155° F.

Ref.—" Piuri or Indian Yellow," in Journ. Soc. Arts. xxxii. 1883, pp. 16–17.—" Mango " (Mangifera indica), in " Report on the Condition of Tropical and Semi-Tropical Fruits in the United States," in 1887, Div. of Pomology, U.S. Dept. of Agric. Bulletin No. 1, 1888, pages 27–33, making mention, and in some instances describing, 62 varieties.—" Mangifera indica, The Mango Tree," in Dict. Econ. Prod. India, v. part 1, 1891, pp. 146–156; giving habitat; history; cultivation; cultivated races, including a descriptive list of the following good sorts: " Afooz," " Kuabogh," " Durbhungah-Bombay," " Safada," " Gopalbogh," " Kakoria," " Kurrelna," " Banka " (twisted), " Ameercola," " Dilpusund," " Durma " or " Derrima," " Kishenbogh Durbhungah," " Kishenbogh," " Lerrua " or " Lerrna," " Shah pusund " (generally called Malda), " Gowraya Malda," " Kumukht," " Buhpali," " Inerna " (this is the largest Mango, some specimens attaining a weight of 4 lb.), " Kerbuza " (or Melon) Mangoes, including " Naroika," " Mohedenugger " and " Dhoola walla kerbusa "; Budaya Mangoes, including " Khari Budaya," " Terha Kellua," " Fuzlee Bewa," " Jalli bund," " Durbhungah Budaya," " Nukkna Lungra," " Mohunbogh," " Mohur Thakoor," " Tars " (the native name of the Borassus Palm, the two fruits bearing some resemblance to each other). The economic uses of the various parts of the tree are described, and a statement of the chemical composition of the fruit is included.—" Preserving Mangoes," E. M. Shelton, of the Department of Agriculture, Queensland, in Bull. Bot. Dept. Jamaica, 1894, pp. 111, 112; including instructions for canning, making marmalade and jelly. In the experiments 13 good-sized Mangoes gave one pint of jelly and five quarts of marmalade.—*Ibid*, in The Agricultural Record, Trinidad, v. Aug. 1891, pp. 76–78, being a Reprint from Leaflet issued by the Department of Agriculture, Brisbane, 1891.—" Fabrication de l'eau-d-vie de Mangue," in Rev. Cult. Col. i. 1897, p. 151.—" The Mango " (Mangifera indica), in Bull. Misc. Information, Roy. Bot. Gardens, Trinidad, July, 1899, pp. 190–219. Cultural notes and descriptions of the following varieties, with an outline figure of each: " Gordon," " Peters " (" Bombay " Mango of Jamaica), " Julie," " Father Louis," " No. 11 " of Jamaica or " Reine Amelie " of Martinique, " Prestoe," " Mistake," " Golden Mango " or " Mango D'or," " Grand Verte," " Calabash," " Baladooray " or " Big Massa " (the tree is the largest of all the Mangoes and grows to a very large size, but is by no means a good bearer), and " Belle Maria."—" Grafting the Mango Tree," Knight, in Queensland Agric. Journ. vii. 1900, pp. 41, 42.—" The Mango," Fawcett & Harris, in Bull. Bot. Dept. Jamaica, viii. 1901, pp. 161–178; to which is attached an article on " The Shipping of Mangoes and the Reason for their absence in the Markets of the United States," by John W. Harshberger, Ph.D., Philadelphia; *Ibid*, in The Sugar Journal and Tropical

Cultivator, Sept. 15th, 1902, p. 51.—" Indian Mangos," Maries, in Journ. Roy. Hort. Soc. xxvi. 1901-02, pp. 755–770, with descriptions and illustrations of the following choice varieties: " Nak kua " or Nose Mango ; " Afooz " or " Alfonzo " ; " Durbhungah," Bombay ; " Fukura " or " Fakir Walla " Amun of Gwalior ; " Péary," " Pairi," " Peter," or " Perara," Bombay ; " Shah Pusund " ; " Ennurriva " ; " Ameer Golah " or " Gola," Madras ; " Valajah Pusund," Madras ; " Dharma " ; " Buckley's Gowraya," Maldah and Durbhungah ; " Barka " ; " Rhari Budaya," Durbhungah ; and " Mohur Takoor."—" Mangifera indica," in Manual of Indian Timbers, Gamble, pp. 211, 212 (Sampson Low, Marston & Co., Ltd., London, 1902) ; including an Analysis of the Ash of Sapwood and Heartwood.—" The Mango in Porto Rico," Collins, U.S. Dept. of Agric. Bureau of Plant Industry, Bull. No. 28, 1903, pp. 1–36. Covering origin ; description ; culture, including methods of propagation by seed, inarching, layering and patch-budding, and uses. Descriptions and illustrations of the following forms : " Mango de Mayaguez," " Mangotina," " Melocoton," " Mango de rosa," " Pina," " Largo," " Mango," " Jobos," " Redondo," &c. Packing and shipping, with illustration showing method of packing and a few notes on the market ; 15 plates.—" The Mango," in The Propagation of Tropical Fruit Trees and other Plants, Oliver, U.S. Dept. of Agric. Bull. No. 46, 1903, Bureau of Plant Industry, pp. 8–15 ; prospects as a fruit tree ; propagation in India ; propagating tests at the Department: best age for wood, thick bark of Mango an obstacle in budding, knife for budding the Mango, methods which show best results, applying the buds, when to bud, selection of budding material, raising seedling stocks, transplanting young seedlings, importing Mango scions.—" Mango Bark from Demerara," with Chemical Analysis, in Tech. Rep. and Sci. Papers, Imp. Inst. 1903, pp. 200, 201.—" On the Budding of Mangos," Harris, Bull. Dept. Agric. Jamaica, 1903, pp. 253–255.—" Mangoes," l.c. pp. 262–263, giving proportional parts of the fruit of " No. 11," " Yam," " Bombay," " Black," and chemical composition of same.—The Mango : Its Cultivation and Varieties, in Trop. Agric. Ceylon, 1903, pp. 156, 157.—" Mangifera indica," in Man. Gard. India, Firminger, pp. 256–261 (5th ed. Cameron ; Thacker Spink & Co., Calcutta, 1904).—" Starch of the Mango," Buttenshaw, in West Indian Bull. v. 1904, pp. 20–22, with micrograph (f. 5) of starch of the Mango seed × 300 ; and micrograph (f. 6) of starch of the Green Mango × 300.—" The Mango : Its Culture and Varieties," Marshall Woodrow, pp. 1–32, including descriptions of 80 famous Mangoes ; illustrated (Alexander Gardner, Paisley ; H. G. Cook, 41, Wellington Street, Covent Garden, London, 1904).—" Mangos at the Colonial and Indian Exhibition," in Bull. Misc. Information, Roy. Bot. Gardens, Trinidad, 1905, pp. 240, 241.—" The Mango Weevil " (*Cryptorhynchus mangiferae*, Fabr.), Maxwell-Lefroy, in Agric. Journ. India, 1906, pp. 164, 165, with illustration of beetle.—" Le Greffage du Manguier," in Journ. d'Agric. Tropicale, Paris, May, 1906, pp. 138–140.—" Gum-Resin of the Mango," Hooper, in Pharm. Journ. [4] xxiv. 1907, p. 718.—" Mangifera indica," in Comm. Prod. India, Watt, pp. 764, 765 (John Murray, London, 1908).—" Mangoes in Ceylon," Macmillan, in Trop. Agric. Ceylon, 1908, pp. 135, 136, with descriptions and illustrations of the principal types of Mangoes grown in Ceylon; "Rupee," "Jaffna," "Baittee" or Bombay, "Parrot," "Mi-amba" (Honey Mango), and "Etamba" (seed Mango).—"Mangoes for Export," Cousins, in Bull. Dept. Agric. Jamaica, i. 1909, pp. 48–51, illustrated.

ANACARDIUM, Rottb.

Anacardium occidentale, *Linn.*; Fl. Trop. Afr. I. p. 443.

Ill.—Rheede, Hort. Mal. iii. t. 54; Rumpf. Amb. i. t. 69; Plenck. Ic. t. 319; Jacq. Icon. Select. Stirp. Am. t. 181, f. 35 (fruit); Tuss. Ant. iii. t. 13; Desc. Ant. vii. t. 507; Dict. Sc. Nat. t. 261; Berg. Charact. t. 73, No. 535; Blanco, Fl. Filip. t. 116; Nooten, Fl. Java, t. 25; Bedd. Fl. Sylv. t. 163; Baillon, Hist. Pl. v. ff. 322–324; Vidal, Fl. For. Filip. t. 36 B; Köhler, Med. Pflan. iii.; Ill. Hort. 1885, pp. 157–159; Le Jard. 1889, pp. 33, 34; Greshoff, Nutt. Ind. Pl. t. 2; Journ. Bomb. N.H. Soc. x. 1895, p. 88; Contr. U.S. Nat. Herb. ix. t. 29; Freeman & Chandler, World's Comm. Prod. p. 275; Sim, For. Fl. Port. E. Afr. t. 28.

Vernac. names.—Kaju (Lagos, *Dawodu*); Cajueiro (Port. Angola, *Welwitsch*).—Cashew Nut; Cashew Apple; Noix de Kasjoe.

Indigenous to South America and the West Indies. Introduced to Tropical Africa, Asia, and many warm countries.

The roasted kernels are commonly eaten as dessert. The kernels yield by expression about 40 per cent. of a nutritious oil, the quality of which is considered equal to almond or olive oil.

Cardol or Cashew Apple Oil is obtained from the shell of the nut; it is black, acrid and vesicant; a good preservative for woodwork, books, &c., being a good protection against white ants. According to Dymock, Cardol is prepared in large quantities in the Goa territory during the process of roasting the nuts, and is used there for tarring boats (Pharm. Journ. [3] vii. p. 730). In India it is used as an anæsthetic in leprosy and as a blister in warts, corns and ulcers (Watt, Dict. Econ. Prod. India).

There is a fair amount of trade done in the nuts, and the demand seems good. The exports from India during 1907 amounted to 8,507 cwts., valued at about R. 2 lakhs. The chief customers were France and the United Kingdom (Trop. Agric. Ceylon, 1908, p. 311). September and October has been advised as the best time for nuts to reach Marseilles (Agric. Bull. Str. Sett. & Fed. Malay St. 1906, p. 377). Cashew Nuts are imported into Bombay from Goa in very considerable quantities; the kernels are valued at about Rs. 18 per cwt. (Watt. Comm. Prod. India, p. 66).

Cashew Nuts or Cashew Kernels are charged for at the Docks as Pistachio Kernels: landing 5*d.* per cwt.; re-weighing, re-piling or re-housing 2½*d.* per cwt.; delivery to land conveyance 2½*d.* per cwt., to water conveyance 4*d.* per cwt.; rent 6*d.* per ton per week (Table of Rates, &c., London & India Docks Co. 1904, p. 44).

The tree yields a gum. A sample from S. Nigeria has been examined at the Imperial Institute; it consisted of a mixture of small almost colourless tears, with masses of dark-brown or almost black gum, weighing about 2 ozs., with no marked taste or odour ; on burning it yielded 1 per cent. of ash. There would be no prospect of selling it in this country (Govt. Gaz. S. Nigeria, July 15th, 1908, Suppl. p. 3).

The juicy fleshy pedicel may be eaten when ripe ; it makes a good preserve, and according to Watt (Dict. Econ. Prod. India) is a remedy for scurvy. From this part of the fruit a spirit may be distilled which in some localities is an important beverage. The Portuguese in Goa consider the spirit to be a valuable diuretic, and they apply it externally in rheumatism (Dymock, in Pharm. Journ. [3] vii. p. 731). In Mozambique, Portuguese East Africa, there is an area of about 12,000 acres where the tree grows freely, and the distillation of the spirit, subject to heavy taxation by the Portuguese Government, is an industry of some importance. It is stated that during the Cashew season (October, November, and December) the natives give themselves up to their favourite beverage, and during that time they become perfectly useless (Cons. Rep. Ann. No. 1463, 1894, p. 14). It does not appear that the distillation of Cashew spirit is anywhere more than of local importance. In Brazil a wine is made from it, closely resembling Madeira, with a reputation for use in so-called torpidity of the liver (Nat. Stand. Disp. 1905, p. 174).

The sap of the tree is a natural and indelible marking ink.

The bark contains tannin. Christy calls it "diabetes bark," and recommends an infusion in the treatment of "diabetes insipidus" (New & Rare Drugs, May, 1888, p. 6).

The wood is used for packing-cases in Ceylon and Burma ; for boat-building and for making charcoal ; the weight is 30 to 38 lbs. per cubic foot (Gamble, Man. Ind. Timb. p. 214).

The tree can be propagated by seed (nuts), but does not transplant readily ; the seeds may be sown in bamboo pots if raised in the nursery, or sown at once in positions intended to be permanent. It will flourish in comparatively dry soil and under an irregular rainfall. In the Mozambique region above mentioned, the aridity of the soil, irregularity of rains, as well as the absence of labour, are the chief causes of failure with produce other than Cashew trees, &c. (Cons. Rep. l.c.). In India it is established in the coast forests, especially in sandy places, and in S. India it has been found of value in coast-dune reclamation (Watt, Comm. Prod. India, p. 65). It does well in Palmyra Groves (Gamble, l.c.).

Ref.—"Anacardium occidentale, Pomme d'Acajou ou de Kasjoe," in Ill. Horticole, 1885, pp. 157–159.—Med. Pflan. Köhler, iii. 3½ pp. —"La Pomme et la Noix de Cajou," De Bois et P. Maury, in Le Jardin, 1889, pp. 33, 34.—Dict. Econ. Prod. India, i. 1889, pp. 232, 233.—Nuttige Indische Planten, Dr. Greshoff, pp. 5–8 (J. H. De Bussy, Amsterdam, 1894).—"The Poisonous Plants of Bombay," Surg.-Major Kirtikar, in Journ. Bomb. N.H. Soc. x. 1895, pp. 88–107.—Dip. & Cons. Rep. Ann. No. 1463, 1894, Mozambique, pp. 14, 15 ; Reprint ("Cashew Spirit") in Kew Bull. 1898, pp. 28, 29.—"Anacardium occidentale," Dr. De Cordemoy, in Ann. Inst. Col. Marseille, vi. fasc. 2, 1899, "Gommes Resines," pp. 49, 50.—"Analysis of the Oil of Anacardium occidentale," in Tech. Rep. & Sci. Papers, Imp. Inst. 1903, p. 126.

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